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# A NEW SPECIES OF *DESMANTHODIUM* (ASTERACEAE, HELIANTHEAE) FROM OAXACA, MEXICO

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## ABSTRACT

A new species, ***Desmanthodium hintoniorum*** B.L. Turner, is described from the state of Oaxaca, México (Mpio. Miahuatlán). It is closely related to the Guatemalan species, *D. guatemalense* Hemsl., but differs in having narrower, nearly entire elliptical leaves and being glabrous throughout, including all floral parts.

KEY WORDS: Asteraceae, Heliantheae, *Desmanthodium*, México, Oaxaca, systematics

Routine identification of Mexican Asteraceae has revealed the following novelty.

***DESMANTHODIUM HINTONIORUM*** B.L. Turner, *spec. nov.* TYPE: MEXICO. Oaxaca: Mpio. Miahuatlán, La Sirena, 2525 m, 23 Oct 1995, *Hinton et al. 26409* (HOLOTYPE: TEX!).

Similis *D. guatamalensi* Hemsl. sed foliis ellipticis et integris vel paene integris (vice foliorum ovatorum et dentatorum), caulibus, foliis, partibusque floralibue ubique glabris (vice diverse pubescentium).

Shrub to 1.5 m high, the stems clearly woody and glabrous throughout. Leaves mostly 10-12 cm long, 3.0-3.5 cm wide; petioles 2-4 mm long; blades narrowly elliptical, pinnately nervate, gradually tapering to the petioles, the margins with minute well-spaced, denticulate teeth, but seemingly entire upon superficial inspection. Heads much congested and terminal on stout peduncles 0.5-2.0 cm long, the syncephalous structure ca. 1.5 cm high and 2-3 cm across. Bracts ovate, glabrous, subcoriaceous, 8-10 mm long, 5-6 mm wide, not forming a well-defined involucral-bound head. Receptacle plane, glabrous. Pistillate florets 2, fertile; ligule absent, the tube ca. 1.5 mm long; achenes ellipsoid, glabrous, completely enclosed in fused, elliptical (in outline) bracts, the latter 6-7 mm long, ca. 2.5 mm wide, glabrous throughout. Disk florets ca. 8, sterile, the style branches fused, forming a conical brush ca. 2 mm long;

corollas white, glabrous, 5-lobed, the lobes ca. 1.4 mm long with ill-defined veins, these scarcely marginal, if at all; base of style surrounded by a well defined nectary ca. 0.75 mm high; achenes (although sterile), elongating at anthesis up to several times their bud-size, so as to resemble stout stalks 5-10 mm long.

This taxon is clearly closely related to the more southern, *Desmanthodium guatemalense* Hemsl. but differs in having narrower, elliptical, nearly entire leaves, and being glabrous throughout, including all floral parts. So far as known, *D. guatemalense* does not occur in Chiapas or elsewhere in México, being confined to Guatemala and Honduras.

It is a pleasure to name this for the Hinton family, several generations having now added, and continue to add, numerous remarkable Mexican collections to the research institutions of North America.

## ACKNOWLEDGMENTS

I am grateful to Gayle Turner for the Latin diagnosis, and to her and Piero Delprete for reviewing the paper.

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# ADDITIONS TO THE FLORAS OF COLORADO AND NEW MEXICO

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## ABSTRACT

*Zigadenus virescens* (Kunth) Macbr. is added to the west-slope flora of Colorado. Thirteen new records are added to the New Mexico flora including *Artemisia pygmaea* A. Gray, *Berteroa incana* (L.) DC., *Cleomella palmerana* M.E. Jones, *Eleocharis bella* (Piper) Svenson, *Epilobium lactiflorum* Hausskn., *Hackelia ursina* (Greene *ex* A. Gray) I.M. Johnston var. *pustulosa* (Macbr.) J.L. Gentry, *Hypoxis hirsuta* (L.) Cov., *Huperzia lucidula* (Michx.) Trev., *Lycopodium clavatum* L., *Malacothrix glabrata* (D.C. Eat.) A. Gray, *Senecio amplectens* A. Gray var. *holmii* (Greene) Harrington, *Senecio integerrimus* Nutt., and *Solidago speciosa* Nutt. var. *pallida* Porter. All but one are native North American taxa.

KEY WORDS: Flora, Colorado, New Mexico

Botanical field surveys and curatorial work at the University of New Mexico Herbarium (UNM) by the authors have resulted in one new record for the Colorado flora and thirteen additional records of New Mexico vascular plants. All but one are native North American taxa and seven represent significant disjunctions in their previously known geographic ranges. This report is prepared as a contribution to the *Working Index of New Mexico Vascular Plant Names* (Roalson & Allred 1995) and to assist the Flora of North America Project. Nomenclature conforms to those two floristic endeavors.

## COLORADO

### LILIACEAE

*Zigadenus virescens* (Kunth) J.F. Macbr. - Eagle Co., Tennessee Pass, 3100-3500 msm, 4-6 Sept 1915, *Eggleston 11801* (COLO). Gunnison Co., Rustler's Gulch above Gothic, 3200 m., 28 Aug 1938, *Ewan 11796* (COLO); West Elk Mountains, summit of McClure Pass, 1.3 km from main Hwy along dirt road following the ridge eastward, in wet depressions in aspen forest, elev: 2670 msm, 10 July 1994, *W.A. Weber & R.C. Wittmann 19070* (COLO,UNM). Pitkin Co., W of Redstone, 3050 m, 22 Aug 1980, *Fenton s.n.* (COLO); White River National Forest, Maroon Bells Snowmass Wilderness, Hell Roaring Creek, T9S R87W Section 31, Subalpine meadow, ca. 3350 m, 20 Aug 1995, *T. Hogan 2968* (COLO,UNM). Routt Co., Grand Lake, 4 July 1937, *K.R. Johnson 571* (COLO); Diamond Park Road, 2 km N of Seedhouse G.S., 45 km N of Steamboat Springs, 18 July 1951, *Weber 6789* (COLO).

Comment: The first Colorado records of a predominantly Madrean species that was previously known from México, southeastern Arizona, and southwestern New Mexico (Hess & Sivinski 1995). These collections represent an approximately 400 km northern disjunction from the nearest known population in the Datil Mountains of northern Catron County, New Mexico. This species is occasionally sympatric and frequently confused with *Zigadenus elegans* Pursh (= *Anticlea elegans* [Pursh] Rydb. of some Colorado authors). *Zigadenus virescens* is distinguished by its campanulate corolla, cernuous flowers at anthesis, and stamens longer than the tepals as compared to the rotate-campanulate corolla, erect flowering pedicels, and usually longer tepals of *Z. elegans*.

## NEW MEXICO

### ASTERACEAE

*Artemisia pygmaea* A. Gray - McKinley Co., Fort Wingate, NE side of military reservation ca. 1 km NW of Wingate High School, elev: 2100 m, locally common on sodic, red clay of the Chinle Shale Formation with *Sporobolus airoides, Eriogonum microthecum,* and *Atriplex obovata*, 31 May 1994, *R. Sivinski & K. Lightfoot 2710* (UNM); same location, 26 Oct 1994, *W. Hevron 2261* (UNM); 1 km N of frontage road between I-40 and Iyanbito, T15N R16W Section 14, on red clayey sand of Chinle Fma with *Chrysothamnus viscidiflorus, Bouteloua gracilis*, and scattered *Juniperus monosperma*, 26 Oct 1994, *W. Hevron 2262* (UNM).

Comment: First records for New Mexico and a nearly 200 km southern disjunction from the populations vouchered in southwestern Colorado (*Anderson 89-21 & 90-34* [COLO]). Welsh *et al.* (1993) observed this sagebrush on unique substrates that provide habitat for other rare plant species. The Fort Wingate, New Mexico, population is consistent by occurring with the relatively rare *Phacelia cephalotes* A. Gray and the narrow endemic *Erigeron sivinskii* Nesom.

*Malacothrix glabrata* (D.C. Eat. *ex* A. Gray) A. Gray - Hidalgo Co., Peloncillo Mountains, ca. 56 km SSW of Animas, T33S R21W Section 16 SW1/4, elev: 1640 m, rare on flat, rocky (volcanic) hilltop with *Bouteloua hirsuta, Agave palmeri*, and *Malacothrix fendleri*, 26 Apr 1993, *W. Dunmire 1223* (UNM). Luna Co., on NE footslope of Taylor Mountain ca. 10 km ENE of Faywood Hotspring, T20S R10W Section 17 NE1/4, elev: 1600 m, locally rare on rhyolitic soils in desert grassland with *Pleuraphis mutica, Bouteloua curtipendula, Malacothrix fendleri, Ephedra,* and *Fallugia*, 12 Apr 1995, *R. Sivinski 2949* (UNM).

Comment: First records for New Mexico and an eastern range extension from Graham County, Arizona (Kearney & Peebles 1951).

*Senecio amplectens* A. Gray var. *holmii* (Greene) Harrington - Taos Co., Sangre de Cristo Mountains, west slope of Wheeler Peak, elev: 3650 m, scree slopes at treeline, 20 Jul 1986, *C.F. Keller 328.2C* (UNM).

Comment: First record for New Mexico. A high elevation, short-stature variety (with basal leaves dominant) previously thought to be a Colorado endemic (Weber 1990). Variety *amplectens* also occurs in northern New Mexico, but at different localities and usually in subalpine habitats.

*Senecio integerrimus* Nutt. var. *integerrimus* - Rio Arriba Co., Hwy 84 N of Chama and 1.6 km S of NM/CO border, moist meadow in open piñon-juniper habitat with *Delphinium nelsonii* and *Phlox caryophylla*, 21 May 1991, *C.F. Keller 656.3* (UNM).

Comment: First record for New Mexico and a minor southern range extension for this widespread, western North American species.

*Solidago speciosa* Nutt. var. *pallida* Porter - Los Alamos Co., Jemez Mountains, Los Alamos, S rim of Pajarito Canyon, 0.5 km E of State Route 4, elev: 2360 m, on dry ridge with *Pinus ponderosa*, 8 Oct 1990, *C.F. Keller 653* (UNM). San Miguel Co., Sangre de Cristo Mountains, Gallinas Canyon west of Las Vegas, T17N R14E Section 14, elev: 2300 m, roadside slopes and ditches, 29 Aug 1994, *C.F. Keller 938C* (UNM).

Comment: First records for New Mexico. The San Miguel County collection is a minor southern range extension from the east slope of the Colorado Rockies (Weber 1990). The Jemez Mountain record represents a 100 km western range extension for the species.

## BORAGINACEAE

*Hackelia ursina* (Greene *ex* Gray) I.M. Johnston var. *pustulosa* (Macbr.) J.L. Gentry - Hidalgo Co., Animas Mountains, lower Indian Creek Canyon, elev: 1850 m, 13 Sept 1975, *W. Wagner 1507* (UNM); Animas Mountains, unnamed canyon above Eckels Tank, T32S R19W Section 8 SW1/4, elev: 1860 m, locally rare on N-facing slope of rhyolitic soil in upper encinal of *Quercus arizonica, Q. hypoleucoides, Rhus trilobata*, and *Yucca schottii*, 21 Aug 1993, *R. Sivinski & L. McIntosh 2531* (UNM).

Comment: First records of this variety in New Mexico. Variety *pustulosa* was previously known from western Chihuahua and southeastern Arizona (Gentry 1974). Variety *ursina* is common in the Black Range and Mogollon Mountains of southwestern New Mexico. Their ranges overlap at the Animas Mountains in the New Mexico boot heel and the Chiricahua Mountains in adjacent Arizona.

## BRASSICACEAE

*Berteroa incana* (L.) DC. - Sandoval Co., Jemez Mountains, La Cueva, intersection of State Route 4 and 126, elev: 2320 m, waste ground at roadside, 5 Aug 1995, *C.F. Keller 976C* (UNM).

Comment: First New Mexico record of this Eurasian weed. An adventive species that is established in North America from Nova Scotia to Washington (Great Plains Flora Assoc. 1986) and is spreading to southern montane areas in Colorado (Weber 1990) and New Mexico.

## CAPPARACEAE

*Cleomella palmerana* M.E. Jones - San Juan Co., west of Rattlesnake, 26 Apr 1947, *O. Clark 14107* (UNM). Identified and annotated by Hugh Iltis (WIS), 1983.

Comment: First record for New Mexico and a minor southern range extension from southwestern Colorado (Iltis, letter to Lowrey).

## CYPERACEAE

*Eleocharis bella* (Piper) Svenson - Rio Arriba Co., Tusas Mountains, Posos Lake, T27N R8E Section 15, elev: 2630 m, abundant on shallow lake bed within conifer forest, on drying mud with *Plagiobothrys scouleri* and *Veronica*, 6 Aug 1991, *R. Sivinski 1771* (NMC,UNM); Tusas Ridge west of Petaca, T26N R9E Section 6 NW1/4, on mud of small impoundment created by logging disturbance in ponderosa pine forest, 30 July 1992, *R. Sivinski 1928* (UNM). Sierra Co., Black Range, pond at head of Sawmill Canyon, T10S R10W Section 20 NW1/4, elev: 2350 m, 16 Aug 1982, *R. Fletcher & C. Barnard 6688* (UNM).

Comment: Although Cronquist *et al.* (1977) acknowledged this species as occurring in New Mexico, Martin & Hutchins (1980) included it in their *Flora of New Mexico* as expected in the southwestern part of the state, but with no certain records. These collections document the species for southwestern New Mexico and also the north-central part of the state.

## LILIACEAE

*Hypoxis hirsuta* (L.) Cov. - Cibola Co., Zuni Mountains, Agua Fria, 26 km W of Grants, T10N R12W Section 34, ponderosa pine forest, elev: 2440 m, 22 Aug 1963, *K.K. Goodrow 756* (UNM). Identified and annotated by Doug Henderson (ID) and Anita Cholewa (MIN), 1990.

Comment: Martin & Hutchins (1980) included this species in their *Flora of New Mexico* as expected in the northeastern corner of the state. This collection documents the species for New Mexico, but in the northwestern part of the state. The nearest previous collections are from southeastern Colorado (Weber 1990).

## LYCOPODIACEAE

*Huperzia lucidula* (Michx.) Trev. - Santa Fe Co., 4 km N, 4.4 km E from Santa Fe Plaza on ski run road, 9 Aug 1961, *C.K. Dixon A-289* (UNM). Identified and annotated by Michael Windham (UT), 1990.

Comment: First record of the genus and species for New Mexico. The range of this species is illustrated in the *Flora of North America* as east of the Mississippi River Valley (Flora of North America Editorial Committee 1993). This New Mexico collection represents a significant disjunction to the southern Rocky Mountains.

*Lycopodium clavatum* L. - Sandoval Co., Sandia Mountains, N of Sandia Crest on trail through moist Canadian forest, elev: 3050 m, 23 Apr 1965, *C.B. Jones 12-2* (UNM). Identified and annotated by Michael Windham (UT), 1990.

Comment: First record of this species for New Mexico. The North American distribution of this cosmopolitan species is the northeastern United States, southern Canada, and the Pacific northwest (Flora of North America Editorial Committee 1993). It also occurs in the mountains of México. This New Mexico collection represents a significant disjunction to interior southwestern North America.

ONAGRACEAE

*Epilobium lactiflorum* Hausskn. - Taos Co., woods on west exposure along trail to Wheeler Peak, 36°33′ 20″ N 105°25′ 45″ W, elev: 3370-3400 m, 8 July 1967, *H. Mackay 5T-214* (UNM). Identified and annotated by Peter Hoch (MO), 1977.

Comment: First record for New Mexico and a southern range extension from the subalpine flora of Colorado (Weber 1990).

## ACKNOWLEDGMENTS

We are grateful to Kelly Allred (NMCR), Rich Spellenberg (NMC), and Bill Weber (COLO) for reviewing the manuscript and providing helpful comments. Bill Weber brought the *Zigadenus virescens* collections to our attention and loaned specimens for review. We also thank Bill Dunmire and Bill Hevron for allowing us to publish their collection records.

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# *MUHLENBERGIA MONTANA* AND *M. QUADRIDENTATA*, A CASE OF A NATURAL HYBRID SWARM

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## ABSTRACT

This study examined variation in morphology for 49 populations of *Muhlenbergia montana* (Nutt.) Hitchc. and *M. quadridentata* (H.B.K.) Kunth representing the sympatric range of the species. These and previous results suggest the formation of hybrid swarms between the two species. Suspected hybridization is confirmed by the morphometric analysis of the species growing in this area. Flavonoid profiles, anatomical, and cytological features seem to support this theory.

KEY WORDS: *Muhlenbergia montana*, *Muhlenbergia quadridentata*, hybrid swarm, Poaceae

## RESUMEN

El presente estudio examinó la variación morfológica de 49 poblaciones de *Muhlenbergia montana* (Nutt.) Hitchc. y *M. quadridentata* (H.B.K.) Kunth, representando el área de distribución simpátrica de las especies. Estos y previos resultados sugieren la formación de camadas de híbridos entre las dos especies. La hibridación sospechada se confirma a través del análisis morfométrico de las especies que ocurren en esta área. El perfil de flavonoides y los caracteres anatómicos y citológicos parecen apoyar esta teoría.

PALABRAS CLAVES: *Muhlenbergia montana*, *Muhlenbergia quadridentata*, camadas de híbridos, Poaceae

*Muhlenbergia montana* (Nutt.) Hitchc., a widely distributed species (from Montana to México and Guatemala) is perhaps, a very successful species that along its wide distribution seems to hybridize with putative species; Welsh *et al.* (1987)

reported numerous intermediates formed with *M. filiculmis* Vasey in the Rocky Mountains, while, Herrera-Arrieta & Grant (1993) mention the suspected hybridization with *M. quadridentata* (H.B.K.) Kunth, in the western and central part of México.

Initial macromorphological studies of the *Muhlenbergia montana* complex (Herrera-A. & Bain 1991 and Herrera-Arrieta & Grant 1993, 1994) have shown that some specimens of *M. quadridentata* shared certain features of *M. montana*. Further macromorphological observations of floral and vegetative characters analyzed with multivariate statistical tests and phenetic analyses, augmented by information on pollen fertility and their geographical range of distribution, provide a context for evaluating the taxonomic limits and relationships of these two species.

Phenetic analyses of morphological, anatomical, and flavonoid content data suggested that *Muhlenbergia montana* and *M. quadridentata* hybridize in sympatric areas.

The present analysis attempted to estimate the morphological variation among populations within these two species belonging to the sympatric area of distribution in México, to confirm that hybridization occurs.

## MATERIALS AND METHODS

A study of 49 freshly collected specimens (Table 1) was assembled. The collection locations seemed to cover the sympatric area of distribution of these two species at a range of 2100-3650 m, 17-24° N and 90-105° W. A few other herbarium specimens were selected to represent the morphological variation.

Populations of *Muhlenbergia* vary in size from a few scattered individuals to hundreds of plants covering a large area. Sample sizes were randomly selected of ten to fifteen individuals per population at each location, to maximize the probability of sampling genetically different individuals. Eighteen morphological characters were scored and are shown in Table 2. Many loaned herbarium specimens were reviewed from: CIIDIR, CHAPA, ENCB, HUAA, IEB, and MEXU (acronyms follow Holmgren *et al.* 1990).

The individuals of each population were measured for eighteen continuous macromorphological variables (Table 2), where each OTU is represented by the mean value (measurement) per variable. Application of Cluster Analysis and Principal Component Analysis (PCA) for a phenetic study were the most representative and are elaborated below.

A distribution map (Figure 1) is included, based on over 950 herbarium specimens identified as *Muhlenbergia montana* and *M. quadridentata*. After examination, 49 locations were selected to collect fresh material representing the geographic ranges and putative hybrids. The specimens were measured and recorded.

Table 1. Specimens of *Muhlenbergia* analyzed in this study.

*M. montana* (Nutt.) Hitchc. MEX. AGS: *De La Cerda 3989* (CIIDIR,HUAA). CHIH: *Herrera, Peterson, & Annable 950, 956, 964, 968, 970, 972, 974, 980* (CIIDIR,MTMG,US); *Peña 802* (CIIDIR). DF: *Herrera & Cortés 922, 924* (CIIDIR, MTMG,US). DGO: *Herrera & Acevedo 984* (CIIDIR,MTMG,US); *Acevedo 582* (CIIDIR); *Acevedo & González 529, 534, 535, 536, 537, 540* (CIIDIR); *Herrera & González 1022* (CIIDIR). MOR: *Herrera & Cortés 926, 928* (CIIDIR,MTMG,US). OAX: *Herrera 900* (CIIDIR,MTMG); *Carrillo 361* (MEXU,ENCB).

*M. quadridentata* (H.B.K.) Kunth MEX. COL: *Herrera & Cortés 935, 936* (CIIDIR,MTMG,US). DF: *Herrera & Cortés 911* (CIIDIR,MTMG,US). DGO: *Acevedo & González 527* (CIIDIR,MTMG). HGO: *Chavez 134* (CIIDIR,ENCB); *Mancera 1* (CIIDIR,CHAPA). JAL: *Herrera & Cortés 933* (CIIDIR,MTMG,US). MEX: *Herrera & Cortés 904, 906, 907, 908, 913, 914, 915, 929* (CIIDIR,MTMG,US); *Herrera 241* (CIIDIR,ENCB); *Vega 276* (CIIDIR, CHAPA,ENCB); *Hernández 15/78* (CIIDIR,ENCB). MOR: *Herrera & Cortés 925, 927* (CIIDIR,MTMG,US). PUE: *Herrera & Cortés 916, 917, 918, 919* (CIIDIR,MTMG,US). OAX: *Herrera 899* (CIIDIR,MTMG).

Table 2. Coding of macromorphological variables used in the phenetic analysis.

1. Leaves length, num (for numerical).
2. Old sheaths, 1) present, 2) absent.
3. Lamina leaves, 1) involute, 2) flat, 3) flat-involute.
4. Leaf width, num.
5. Ligule length, num.
6. Ligule shape, 1) truncate, 2) apiculate.
7. Spikelets length, num.
8. First glume length, num.
9. Second glume length, num.
10. First glume width, num.
11. Second glume width, num.
12. Second glume teeth length, num.
13. Lemma length, num.
14. Lemma pubscence, 1) in base and margins, 2) in the whole surface.
15. Lemma awn length, num.
16. Palea length, num.
17. Palea pubescence, 1) scarce, 2) moderate.
18. Anthers length, num.

Flavonoid profiles were taken from (Herrera-A. & Bain 1991). A data matrix of morphological characters (Tables 3 & 4) was submitted to a Principal Component Analysis (Figures 2-4) and a cluster analysis using the unweighted pair-group mathematical average clustering analysis (UPGMA) of the Canberra distance matrix through the use of the Multivariate Statistical Package Version 1.31, Kovach (1987) to generate the dendrogram (Figure 5).

Differential staining (Alexander 1969) of aborted and nonaborted spores was used to assess sterility in the suspected hybrid populations, results are presented in Table 5.

## RESULTS AND DISCUSSION

*Muhlenbergia quadridentata* is often confused with *M. montana* (McVaugh 1983; Herrera-A. & Bain 1991; Herrera-Arrieta & Grant 1992). Field observations of the Mexican populations of these two species suggest that, although the two taxa can often be easily recognized in the field, variation between the distinguishing characters and the presence of intermediate forms have caused confusion in this group.

*Muhlenbergia montana* is more widely distributed, at elevations from 2000 to 3100 m, from 15° to 45° N and 90° to 112° W. *Muhlenbergia quadridentata* grows mostly at higher altitudes (more than 3000 m), and from 17° to 21° N, 96° to 102° W. Scattered populations were found close to 2000 m, at higher latitudes 24° N and 105° W. The former has spikelets and anthers shorter than *M. quadridentata*, with glumes subequal, and the second glume 3-toothed and conspicuously but shortly 3-awned.

These two species seem to form a group on the basis of their flavonoid content (Herrera-A. & Bain 1991). The flavonoid profiles show that *Muhlenbergia montana* lacks four compounds present in *M. quadridentata*; while *M. quadridentata* lacks a compound always present in *M. montana*. These unique compounds are considered diagnostic marks (mark-q and mark-m for the compounds present in one species and absent in the other) in this work. From the twenty populations of *M. montana* studied for flavonoids (Herrera-A. & Bain 1991), fourteen shared having the well defined compounds identified for this species. On the other side, from the seventeen populations studied of *M. quadridentata*, fourteen shared having the seventeen flavonoids characteristic for *M. quadridentata*. The remaining populations (six populations of the former and three populations of the later) have shown a variable mixture of the marked flavonoids. The presence or absence of these compounds revealed key characters to delineate the identity of morphological intermediates between *M. montana* and *M. quadridentata*.

Principal Component Analysis (PCA), using averages of eighteen measured characters (Table 2), was used to produce a graphic representation of the variation among the groups (Figures 2 to 4). Relative positions of individuals on the PC axes represent their relative similarity for the characters used. In this analysis the two species are completely separated by the first two principal components.

Table 3. Data matrix for the characters of *Muhlenbergia quadridentata* (H.B.K.) Kunth used in this study.

| | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | H&C [illegible] | 30 | 2 | 3 | 2.0 | 2.0 | 1 | 4.0 | 2.8 | 4.0 | 0.7 | 1.0 | 1.5 | 3.5 | 1 | 1.0 | 3.0 | 1 | 1.8 |
| [illegible] | H&C 900 | 20 | 2 | 1 | 1.5 | 2.0 | 1 | 4.0 | 2.0 | 3.0 | 0.7 | 1.2 | 0.6 | 3.5 | 1 | 1.0 | 3.0 | 1 | 1.8 |
| [illegible] | H&C 933 | 18 | 2 | 1 | 1.0 | 2.0 | 1 | 4.0 | 1.8 | 3.5 | 0.7 | [illegible] | 0.0 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | VEGA 276 | 22 | 2 | 1 | 1.0 | 3.0 | 2 | 4.0 | 2.0 | 3.6 | 0.6 | [illegible] | 0.4 | 3.4 | [illegible] | [illegible] | [illegible] | [illegible] | 2.0 |
| 5 | H&C 914 | 28 | 2 | 1 | 1.0 | 2.0 | 1 | 4.2 | [illegible] | 3.2 | [illegible] | [illegible] | 0.8 | 4.2 | [illegible] | [illegible] | 3.5 | [illegible] | 2.2 |
| [illegible] | H&C [illegible] | [illegible] | 2 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 2.0 | 4.0 | [illegible] | [illegible] | 1.0 | 4.0 | 1 | [illegible] | 3.5 | [illegible] | [illegible] |
| [illegible] | H&C 917 | 23 | 2 | 1 | 0.8 | 2.0 | 1 | 3.8 | 1.6 | 3.2 | 0.7 | [illegible] | 0.0 | 3.6 | [illegible] | 0.8 | 3.0 | [illegible] | [illegible] |
| [illegible] | H&C 916 | 30 | 2 | 1 | 1.0 | 2.0 | 1 | 4.0 | 1.7 | 3.0 | 0.5 | [illegible] | 0.2 | 3.8 | [illegible] | 0.8 | 3.0 | [illegible] | 2.2 |
| 9 | H&C 918 | 30 | 2 | 1 | 1.0 | 2.0 | 1 | 4.8 | 2.8 | 4.8 | 0.4 | [illegible] | 0.1 | 4.2 | [illegible] | 1.2 | 4.0 | [illegible] | 2.2 |
| [illegible] | H&C [illegible] | 22 | 2 | 1 | 1.0 | 1.5 | 1 | 3.5 | 2.0 | 3.0 | 0.7 | [illegible] | 0.1 | 3.2 | [illegible] | 0.8 | 3.0 | [illegible] | 2.1 |
| [illegible] | H&C [illegible] | [illegible] | 2 | 1 | 1.0 | 2.0 | 1 | 3.8 | 1.4 | 2.8 | 0.7 | [illegible] | 0.5 | [illegible] | [illegible] | 0.7 | 3.5 | [illegible] | 1.8 |
| [illegible] | H&C 915 | 21 | 2 | 3 | 2.0 | 2.0 | 1 | 5.0 | 2.0 | 4.0 | 0.8 | 1.4 | 0.5 | [illegible] | [illegible] | 0.8 | 3.5 | [illegible] | 2.2 |
| 13 | H&C 927 | 18 | 2 | 3 | [illegible] | [illegible] | 2 | [illegible] | 1.2 | [illegible] | [illegible] | [illegible] | 0.3 | [illegible] | [illegible] | 1.2 | 3.0 | [illegible] | 2.2 |
| [illegible] | H&C 911 | 28 | 2 | 3 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 0.2 | 3.0 | [illegible] | 1.0 | 2.5 | [illegible] | 1.8 |
| [illegible] | H&C [illegible] | [illegible] | 2 | 1 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 0.1 | 3.5 | [illegible] | 1.0 | 3.0 | [illegible] | 2.0 |
| [illegible] | H&C [illegible] | 18 | 2 | 1 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 0.1 | 3.5 | [illegible] | 0.9 | 3.0 | [illegible] | [illegible] |
| [illegible] | H&C [illegible] | 16 | 2 | 1 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 0.8 | [illegible] | 0.1 | | [illegible] | 0.8 | [illegible] | [illegible] | 2.0 |
| [illegible] | H&C [illegible] | 12 | 2 | 1 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 0.0 | 4.0 | [illegible] | 1.2 | 3.8 | [illegible] | 2.0 |
| [illegible] | H&C [illegible] | 21 | 2 | 1 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 0.7 | [illegible] | 0.1 | 3.0 | [illegible] | 0.8 | 2.8 | [illegible] | [illegible] |
| [illegible] | H&C [illegible] | 20 | 2 | 1 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 0.5 | [illegible] | 0.5 | 3.5 | [illegible] | 0.9 | 3.2 | 1 | [illegible] |
| [illegible] | H&C [illegible] | [illegible] | 2 | 1 | [illegible] | [illegible] | 2 | [illegible] | [illegible] | [illegible] | 0.4 | [illegible] | 0.2 | 4.5 | [illegible] | 1.2 | 4.0 | 2 | [illegible] |
| [illegible] | CHAVEZ 134 | 11 | 2 | 1 | 1.0 | 8.0 | 2 | 4.0 | 1.8 | 3.0 | | 1.4 | 0.1 | 3.8 | 1 | 0.8 | 3.2 | 1 | 2.0 |
| [illegible] | [illegible] 1578 | [illegible] | 2 | 1 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] RA 1 | [illegible] | 2 | 2 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 25 | H 241 | 11 | 2 | 1 | 1.0 | 2.0 | 1 | 3.2 | 1.8 | 2.8 | 0.6 | 0.8 | 0.5 | 3.0 | 1 | 1.2 | 2.8 | [illegible] | [illegible] |

COLLECTORS= H&C: Herrera & Cortés, HDEZ: Hernández, H: Herrera.

Table 4. Data matrix for the characters used in this study of *Muhlenbergia montana* (Nutt.) Hitchc.

| OTU | Coll # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | ACEV 582 | 22 | 2 | 2 | 1.7 | 2.2 | 1 | 4.5 | 4.0 | 5.0 | 0.7 | 1.0 | 2.5 | 4.2 | 2 | 1.2 | 4.0 | 2 | 2.0 |
| 27 | H&G 1022 | 27 | 2 | 1 | 1.2 | 2.5 | 2 | 3.8 | 2.5 | 3.0 | 0.6 | 0.9 | 1.5 | 3.5 | 2 | 1.7 | 3.0 | 2 | 2.0 |
| 28 | DLC 3839 | 27 | 2 | 3 | 1.5 | 7.0 | 2 | 3.8 | 3.0 | 3.0 | 0.6 | 1.1 | 1.5 | 3.0 | 2 | 1.2 | 2.8 | 2 | 2.0 |
| 29 | A&G 534 | 32 | 1 | 2 | 4.0 | 5.0 | 2 | 4.0 | 3.2 | 4.0 | 0.7 | 1.2 | 2.0 | 4.0 | 2 | 1.5 | 3.8 | 2 | 2.0 |
| 30 | A&G 529 | 27 | 1 | 3 | 1.5 | 4.0 | 2 | 4.0 | 3.0 | 3.8 | 0.7 | 1.2 | 1.5 | 3.8 | 2 | 1.2 | 3.5 | 2 | 1.8 |
| 31 | A&G 535 | 26 | 1 | 2 | 2.2 | 2.5 | 2 | 4.0 | 3.0 | 3.0 | 0.6 | 1.0 | 1.2 | 3.8 | 2 | 1.5 | 3.5 | 2 | 2.2 |
| 32 | CARR 361 | 20 | 2 | 1 | 1.0 | 6.0 | 2 | 3.8 | 3.0 | 3.2 | 0.5 | 0.8 | 1.8 | 3.2 | 2 | 1.5 | 3.0 | 2 | 1.6 |
| 33 | A&G 540 | 21 | 1 | 2 | 1.5 | 3.0 | 2 | 3.5 | 2.0 | 3.0 | 0.6 | 1.2 | 1.0 | 3.2 | 2 | 1.2 | 3.0 | 2 | 2.2 |
| 34 | PENA 802 | 22 | 1 | 2 | 2.5 | 1.5 | 1 | 4.0 | 3.0 | 4.0 | 0.7 | 1.2 | 2.0 | 4.0 | 2 | 1.0 | 3.8 | 2 | 0.0 |
| 35 | H&C 924 | 25 | 2 | 3 | 1.2 | 3.0 | 2 | 4.0 | 2.0 | 3.0 | 0.5 | 0.9 | 0.5 | 3.8 | 1 | 1.2 | 3.5 | 1 | 0.0 |
| 36 | H,P&A 950 | 21 | 2 | 3 | 1.5 | 10 | 2 | 4.0 | 3.5 | 3.5 | 0.4 | 0.9 | 1.5 | 4.0 | 2 | 1.0 | 3.8 | 2 | 2.0 |
| 37 | H&C 928 | 14 | 2 | 1 | 0.5 | 2.0 | 1 | 3.5 | 1.8 | 2.0 | 0.5 | 0.9 | 0.3 | 3.2 | 1 | 1.2 | 3.0 | 1 | 0.0 |
| 38 | H,P&A 968 | 16 | 1 | 1 | 1.0 | 5.0 | 2 | 3.2 | 2.0 | 2.8 | 0.5 | 0.8 | 1.5 | 3.0 | 2 | 1.5 | 2.8 | 2 | 1.8 |
| 39 | H&C 922 | 10 | 2 | 1 | 0.5 | 6.0 | 1 | 3.8 | 2.0 | 3.0 | 0.7 | 1.2 | 1.0 | 3.5 | 1 | 1.2 | 3.2 | 1 | 2.0 |
| 40 | H,P&A 972 | 22 | 2 | 1 | 1.2 | 8.0 | 2 | 4.0 | 2.8 | 3.3 | 0.6 | 1.2 | 1.6 | 4.0 | 2 | 1.1 | 3.8 | 2 | 1.8 |
| 41 | H&C 926 | 18 | 2 | 1 | 1.0 | 2.0 | 1 | 3.0 | 1.5 | 2.2 | 0.6 | 1.0 | 0.3 | 3.0 | 1 | 0.8 | 2.8 | 1 | 2.0 |
| 42 | H,P&A 970 | 21 | 2 | 3 | 1.2 | 15 | 2 | 4.0 | 3.0 | 3.5 | 0.6 | 1.0 | 1.5 | 3.5 | 2 | 0.8 | 3.2 | 1 | 2.0 |
| 43 | H,P&A 974 | 24 | 1 | 3 | 1.5 | 10 | 2 | 4.0 | 3.0 | 3.5 | 0.7 | 1.0 | 1.5 | 3.8 | 2 | 1.5 | 3.5 | 2 | 1.8 |
| 44 | H,P&A 980 | 09 | 1 | 3 | 2.0 | 7.0 | 2 | 4.2 | 3.5 | 3.8 | 0.6 | 1.2 | 2.0 | 4.0 | 2 | 1.1 | 3.8 | 2 | 2.0 |
| 45 | H,P&A 956 | 21 | 2 | 3 | 2.0 | 11 | 2 | 4.0 | 3.0 | 3.5 | 0.6 | 0.9 | 1.5 | 3.8 | 2 | 1.5 | 3.5 | 2 | 1.8 |
| 46 | H,P&A 964 | 11 | 2 | 1 | 1.0 | 10 | 2 | 3.5 | 2.2 | 2.5 | 0.6 | 1.1 | 1.2 | 3.2 | 2 | 0.8 | 3.0 | 2 | 1.8 |
| 47 | H&A 984 | 11 | 1 | 1 | 0.8 | 3.0 | 1 | 3.8 | 2.0 | 2.5 | 0.6 | 1.0 | 0.5 | 3.5 | 2 | 0.8 | 3.3 | 2 | 1.5 |
| 48 | A&G 536 | 28 | 1 | 3 | 2.0 | 3.0 | 2 | 3.8 | 2.5 | 3.2 | 0.8 | 1.1 | 1.5 | 3.5 | 2 | 1.2 | 3.2 | 2 | 2.2 |
| 49 | A&G 537 | 22 | 1 | 2 | 2.5 | 2.5 | 2 | 4.0 | 2.5 | 3.5 | 0.8 | 1.2 | 0.8 | 3.8 | 2 | 1.5 | 3.5 | 2 | 1.5 |

COLLECTORS= ACEV.: Acevedo; H&C: Herrera & Cortés; H&G: Herrera & González; A&G: Acevedo & González; CARR.: Carrillo; DLC: De La Cerda; H,P&A: Herrera, Peterson & Annable.

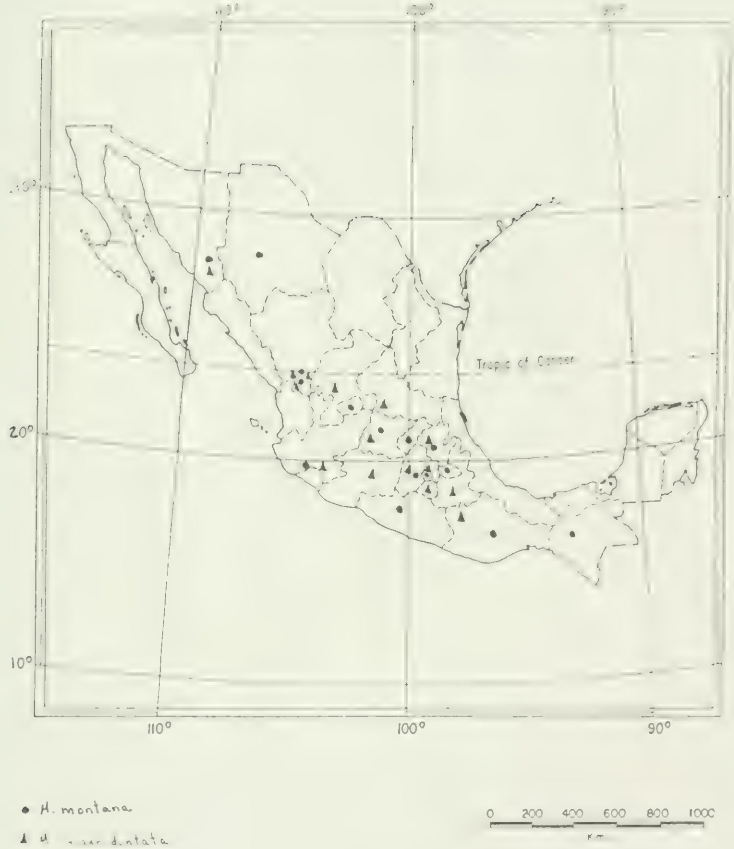

Figure 1. Map of *Muhlenbergia montana* and *M. quadridentata* distribution

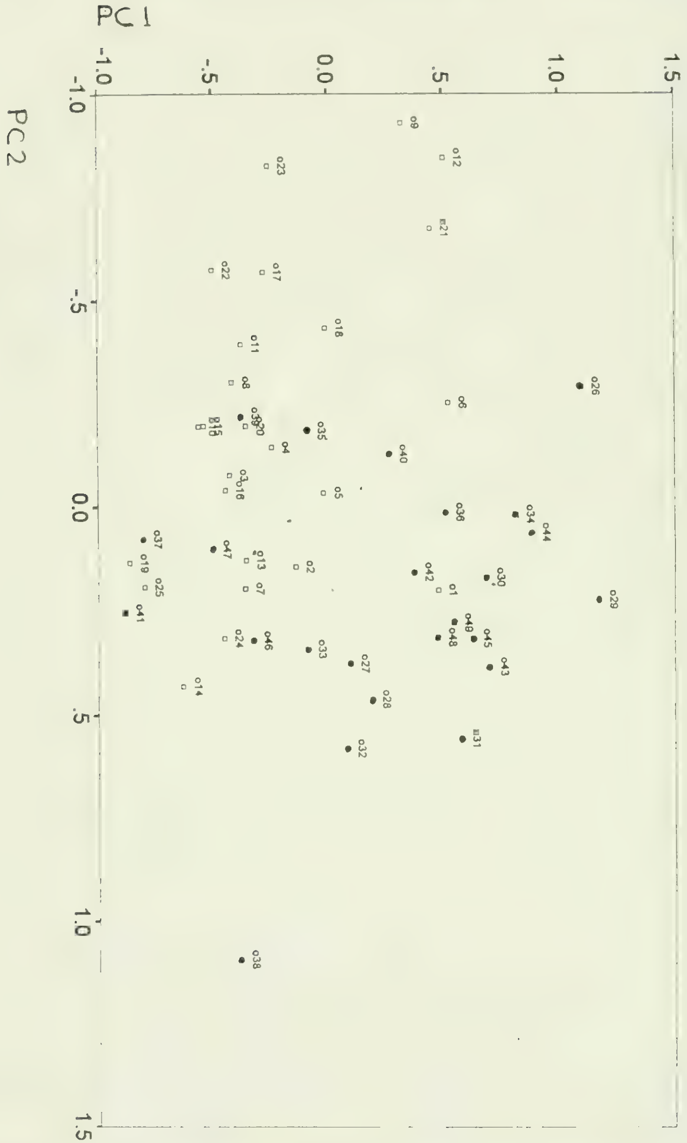

Figure 2. Scatter diagram of individuals from pure and mixed populations of *Muhlenbergia montana* and *M. quadridentata* on Principal Components 1 and 2. Grouping is based on morphological characters.

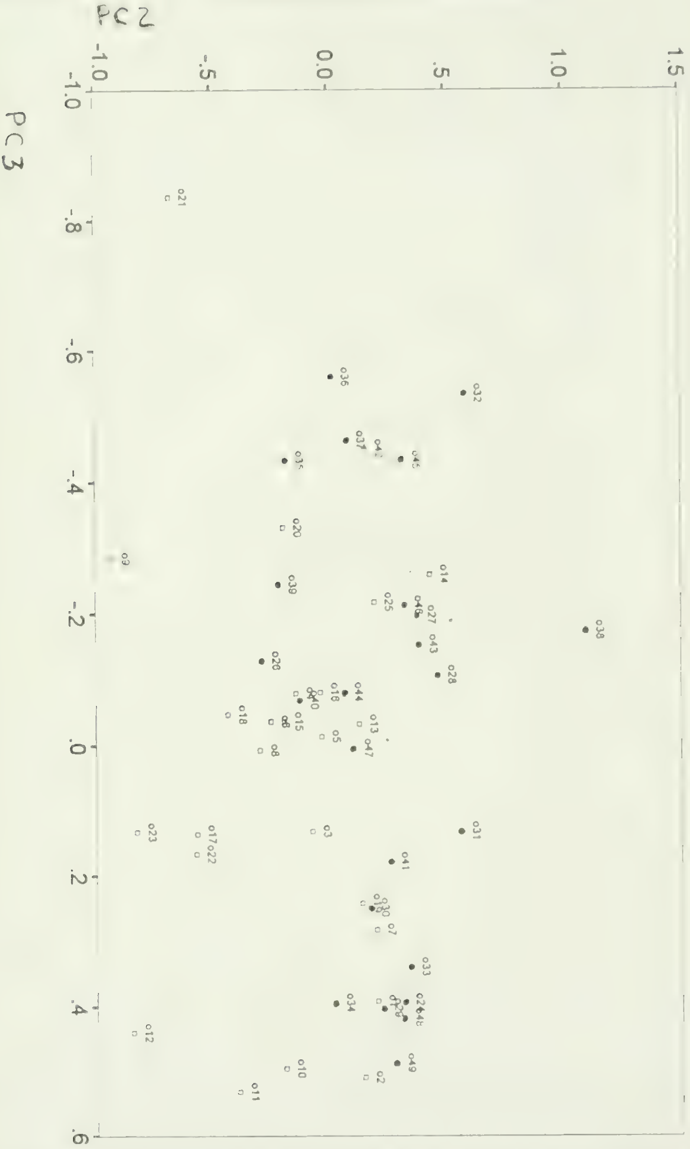

Figure 3. Scatter diagram of individuals from pure and mixed populations of *Muhlenbergia montana* and *M. quadridentata* on Principal Components 2 and 3. Grouping is based on morphological characters.

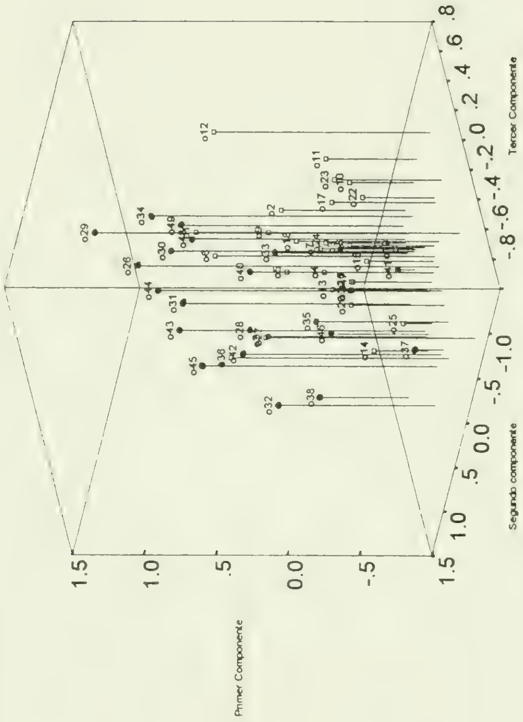

Figure 4. Scatter diagram of individuals from pure and mixed populations of *Muhlenbergia montana* and *M. quadridentata* on Principal Components 1, 2, and 3. Grouping is based on morphological characters.

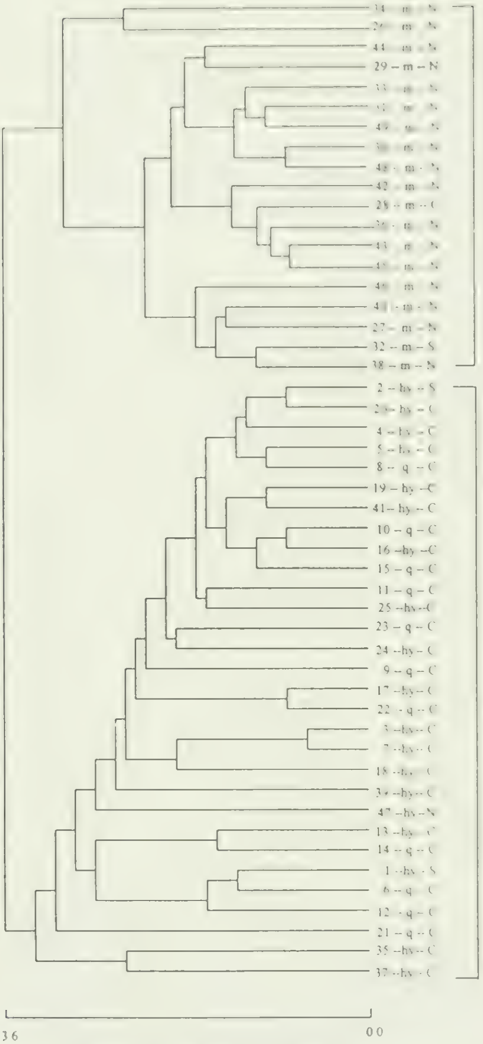

Figure 5. Phenetic relationships among accessions of *Muhlenbergia montana* and *M. quadridentata* as reflected by the cluster analysis (UPGMA) of the Canberra distance (Kovach 1987). Cophenetic correlation 0.923. Population numbers correspond to those in Tables 3 & 4. N= Northern populations, C= Central populations, and S= Southern populations.

Table 5. Percentage of pollen sterility in suspected hybrids.

| OTU | Collector # | Locality | Altitude | Good Pollen | Aborted Pollen |
|---|---|---|---|---|---|
| 1 | *H&C 899* | Sierra de Juárez, Oax. | 2950 m | 98% | 2% |
| 2 | *H&C 900* | Sierra de Juárez, Oax. | 3000 m | 70% | 30% |
| 3 | *H&C 933* | Nevado de Colima, Col. | 3650 m | 91% | 9% |
| 4 | *VEGA 272* | Río Frio, Mex. | 3050 m | UK | UK |
| 5 | *H&C 914* | Amecameca-Tlamacas, Mex. | 3500 m | 75% | 25% |
| 7 | *H&C 917* | E del Popocatepetl, Pue. | 3180 m | 60% | 40% |
| 13 | *H&C 927* | Lagunas de Zempoala, Mex. | 2900 m | 98% | 2% |
| 16 | *H&C 904* | Nevado de Toluca, Mex. | 3400 m | 60% | 40% |
| 17 | *H&C 935* | Nevado de Colima, Col. | 3740 m | 82% | 18% |
| 18 | *H&C 936* | Nevado de Colima, Col. | 4000 m | 70% | 30% |
| 19 | *H&C 929* | La Marqueza, Mex. | 3100 m | 0% | 100% |
| 20 | *H&C 908* | Sultepec, Mex. | 2100 m | 98% | 2% |
| 24 | *MANCERA 1* | Tulancingo, Hgo. | 2240 m | UK | UK |
| 25 | *H 241* | Sierra de Alcaparrosa, Mex. | 2600 m | UK | UK |
| 35 | *H&C 924* | Ajusco, D.F. | 3350 m | 55% | 45% |
| 37 | *H&C 928* | Lagunas de Zempoala, Pue. | 3170 m | 86% | 14% |
| 39 | *H&C 922* | Ajusco, D.F. | 3260 m | 0% | 100% |
| 40 | *H,P&A 972* | Batopilas, Chih. | 2245 m | 0% | 100% |
| 41 | *H&C 926* | Lagunas de Zempoala, Mex. | 2960 m | 46% | 54% |
| 42 | *H 970* | Batopilas, Chih. | 2105 m | 0% | 100% |
| 46 | *H,P&A 964* | Creel, Chih. | 2380 m | 0% | 100% |
| 47 | *H&A 984* | Sierra de Michis, Dgo. | 2500 m | 99% | 1% |

PCA of the population data (Tables 3 & 4) resulted in complete separation between the species into three groups representing *Muhlenbergia montana*, *M. quadridentata*, and their putative hybrids with intermediate scores.

Results from pollen analyses (Table 5) have shown individuals with abortive spores for the intermediate forms that overlap with both species. Populations from the mountains of the Trans-Mexican Volcanic Belt (D.F. and México states) and Sierra Madre Occidental (Chihuahua state) contains 100% abortive spores, this supports the position that *Muhlenbergia montana* and *M. quadridentata* are distinct species that interbreed to form sterile intermediates.

The nature of the character differences between the two species also suggests that *Muhlenbergia quadridentata* is not simply an ecological variant of *M. montana*. If it were, we would expect them to differ in features that are strongly susceptible to environmental modification, such as leaf length or overall size. While they do differ in some of these characteristics, the best characters to distinguish *M. quadridentata* from *M. montana* are: The glumes are subequal and truncate, and the second glume is 3-4 toothed to erose in the former; while the glumes are unequal and apiculate, and the second glume is sharply 3-toothed, mucronate to shortly aristate in the latter. Anatomically *M. montana* presents two secondary Vascular bundles (Vb) placed among the primary ones, Vb's are circular in outline, and the girder is present adaxially and abaxially, as mentioned in Herrera-Arrieta & Grant (1994); while *M. quadridentata* presents only one secondary Vb between the primary, the Vb's are elliptical in outline and the girder is present just abaxially. Flavonoid profiles are also good characters to easily separate these two species (Herrera-A. & Bain 1991).

Unfortunately few chromosome counts of these two species were successful in this work, meiotic counts were possible in three of all the collected populations (Herrera-Arrieta 1995), where *Muhlenbergia quadridentata* showed *n*=10, *M. montana* *n*=10 and *n*=20. Attempts to grow these species under greenhouse conditions for mitotic counts were unsuccessful. Earlier published chromosome counts for *M. montana* are *n*=20 (Reeder 1968).

Pollen size varies from 20 to 25 μ in *Muhlenbergia quadridentata* and from 15 to 35 μ in *M. montana*, however, no correlation between the ploidy level and pollen sizes was established among the populations of this work. The differences in ploidy level between these two species validate a generalization from Stebbins (1950) about the relative distribution of diploids and polyploids. This author states that changes caused by polyploidy can often promote the adaptation of the new types to entirely different habitats from those occupied by their diploid ancestors. The polyploidal level shown by *M. montana* combined with its probable hybridization to other species (*M. filiculmis* in the USA and *M. quadridentata* in México) gives a wider pattern of distribution to it.

Our studies have shown a polarized distribution (north, central-south) in the three data sets examined. The geographical distribution of *Muhlenbergia montana* occurs mostly in northern populations, while *M. quadridentata* and hybrid swarms are found in central and southern populations.

## CONCLUSIONS

Recognition of *Muhlenbergia quadridentata* as a species distinct from *M. montana* is supported by this study. The two species differ mostly in glume shape and size, vascular bundle outline and number, flavonoid profiles, and ploidy level. The two taxa differ in some habitat preferences, they never grow in mixed populations, *M. montana* occurs at altitudes ranging between 2100 and 2700 m, in oak and pine forests, and even in mesophytic forest, forming small clumps; while *M. quadridentata* occurs at higher altitudes (up to 4100 m) in pine forests and alpine grasslands, forming big bunches which cover a large area. The hybrids exhibit morphological and anatomical intermediates, and mixed flavonoid profiles. Principal Component Analysis of natural populations of these two taxa demonstrates clear separation between the well defined species with the sterile hybrids intermediate between them. The two groups obtained from the cluster analysis suggest that there has been reduced gene flow between the northern and central-southern populations. The patterns of variation observed in allopatric populations of this species pair at central and southern sites fits the model of production of hybrid swarms summarized in Grant (1956).

## ACKNOWLEDGMENTS

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# A NEW SPECIES OF *CERASTIUM* (CARYOPHYLLACEAE) FROM OAXACA, MEXICO

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## ABSTRACT

***Cerastium hintoniorum*** B.L. Turner, *spec. nov.*, is described and illustrated. It is known only from Distr. Miahuatlán, Oaxaca, where it occurs in pine-alder forests at 3050 m on Cerro Quiexobra. Among North American species it is most closely related to *C. guatemalense*, differing from the latter in a number of characters, most notably leaf vestiture and fruit size.

KEY WORDS: Caryophyllaceae, *Cerastium*, México, Oaxaca, systematics

Exploration of remote, relatively poorly collected areas of México has yielded the following novelty.

***CERASTIUM HINTONIORUM*** B.L. Turner, *spec. nov.* Figure 1. TYPE: MEXICO. Oaxaca: Distr. Miahuatlán, Quiexobra, 3045 m, "pine and alder forests," *G.B. Hinton* et al. *26114* (HOLOTYPE: TEX).

Similis *C. guatemalensi* Standley, sed foliis sparsim appressis, ubique pilosis (vice foliorum glandulosorum - pilosorum infra), petalis parvioribus, ca. 5 mm longis (vice 6-7 mm longis), et capsulis multum majoribus 12-16 mm longis (vice "7.8-11.8" longis [Good 1984]).

Perennial (?) sparsely branched herbs 15-30 cm high. Midstems pilose with mostly eglandular hairs 0.5-1.0 mm long, upwards the vestiture becoming increasingly glandular-pilose. Leaves more or less similar in shape throughout, but gradually reduced upwards, the larger (lower) leaves, mostly 40-50 mm long, 5-6 mm wide, sparsely pilose on both surfaces with appressed hairs, not at all glandular-pilose. Cymes 8-12 flowered, the bracts not scarious-margined. Pedicels 10-35 mm long, the lower ones longer, moderately pilose like the upper stems, arcuate near the apices when in fruit. Sepals ovate-lanceolate, acute, ca. 5 mm long, 1.5 mm wide, the margins scarious along the upper half, sparsely glandular-pilose on the outer faces.

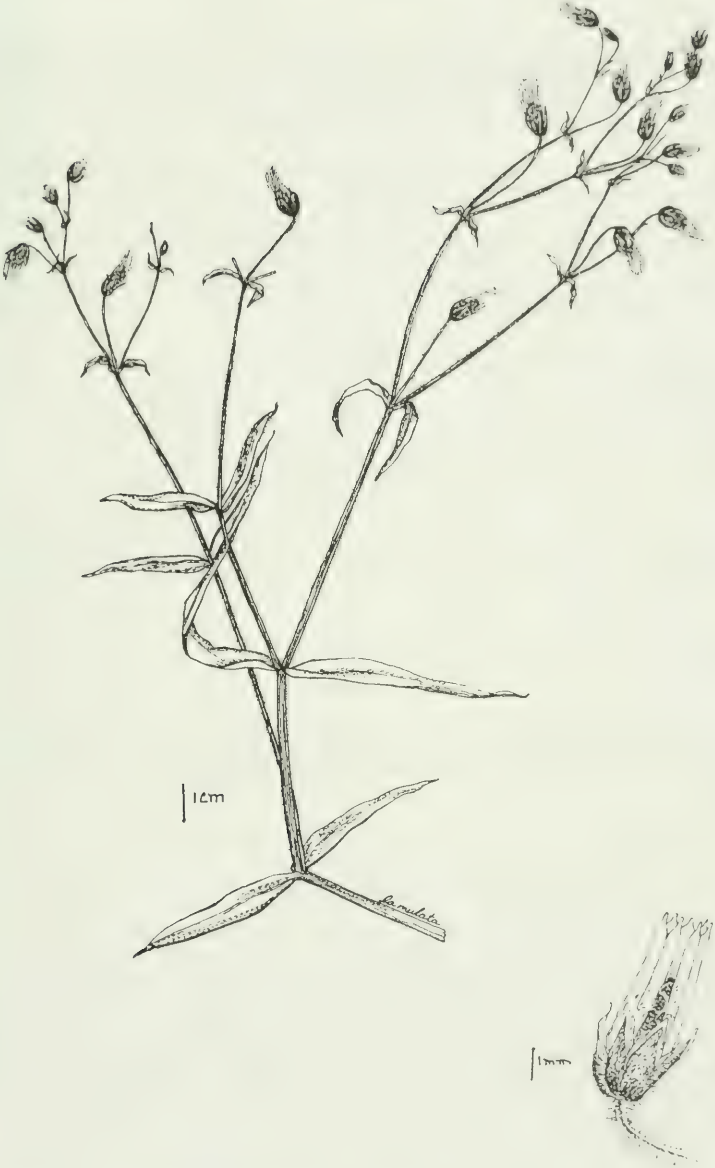

Figure 1. *Cerastium hintoniorum*, from holotype.

Petals white, ca. 5 mm long, bifid ca. 1/4 their length. Filaments ca. 3.2 mm long; anthers ca. 0.2 mm long. Capsules mostly 12-15 mm long, ca. 3.5 mm across, curved, the lobes 10, erect, ca. 0.8 mm long. Seeds ovoid, light brown, ca. 1.0 mm long, 0.9 mm wide, rugose throughout with rounded crests, less so laterally.

This novelty is closely related to *Cerastium guatemalense* Standley, and will key to that species in the excellent revisionary treatment of *Cerastium* for México and Central America by Good (1984). It differs from *C. guatemalense* in having eglandular leaves, smaller petals and much larger capsules (mostly 12-16 mm long vs. 7.8-11.8 mm long). In addition, *C. guatemalense* is known only from southwesternmost Chiapas, México (Mpio. de Motozintla de Mendoza), and closely adjacent Guatemala, with an outlier-population in Costa Rica.

It is a pleasure to name the taxon for the Hinton family, superlatives for which I do not have enough.

## ACKNOWLEDGMENTS

I am grateful to Gayle Turner for the Latin diagnosis, and to her and Ted Delevoryas for reviewing the manuscript. Maria Thompson provided the illustration.

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# A NEW VARIETY OF *PERYMENIUM HINTONIORUM* (ASTERACEAE, HELIANTHEAE)

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## ABSTRACT

A new variety of *Perymenium hintoniorum*, *P. h.* var. ***gypsophilum*** B.L. Turner, is described from southern Nuevo León. It is seemingly confined to gypsum soils and differs from the more northern var. *hintoniorum* of calcareous soils in having eglandular peduncles, smaller leaves and brown anthers. A map showing their distributions is provided.

KEY WORDS: Asteraceae, Heliantheae, *Perymenium*, México, Nuevo León, systematics

Routine identification of Mexican Asteraceae has revealed the following novelty.

***PERYMENIUM HINTONIORUM*** B.L. Turner var. ***GYPSOPHILUM*** B.L. Turner, *var. nov.* TYPE: MEXICO. Nuevo León: Mpio. Aramberri, along road from Aramberri to El Salitre, 1325 m, 26 Oct 1993, *Hinton et al. 23749* (HOLOTYPE: TEX!).

A *P. hintoniorum* B.L. Turner var. *hintoniorum* folia parviora, 3-4 cm longa (vice 8-10 cm longa), et antheras brunneas (vice lotearum) habendo et solum en soliis gypseis (vice calcareorum) crescendo diagnoscendum.

Suffruticose much-branched perennial herbs or shrublets 40-60 cm high. Leaves mostly 3-4(-7) cm long; petioles 2-8 mm long; blades ovate, having 3 principal veins, pubescent above and below with coarse hispid to pilose hairs, the margins serrate to nearly entire. Heads single on eglandular, sparsely strigose, peduncles 3-6 cm long. Involucres ca. 6 mm high, 6-10 mm wide (pressed); bracts 3-seriate, moderately strigose, the outer series broadly ovate, ca. 4 mm long, the inner lanceolate, ca. 6 mm long. Receptacle plane, the bracts linear- lanceolate, persistent. Ray florets 5-11, the ligules yellow. Disk florets 25-40; corollas yellow, ca. 6 mm long, glabrous except

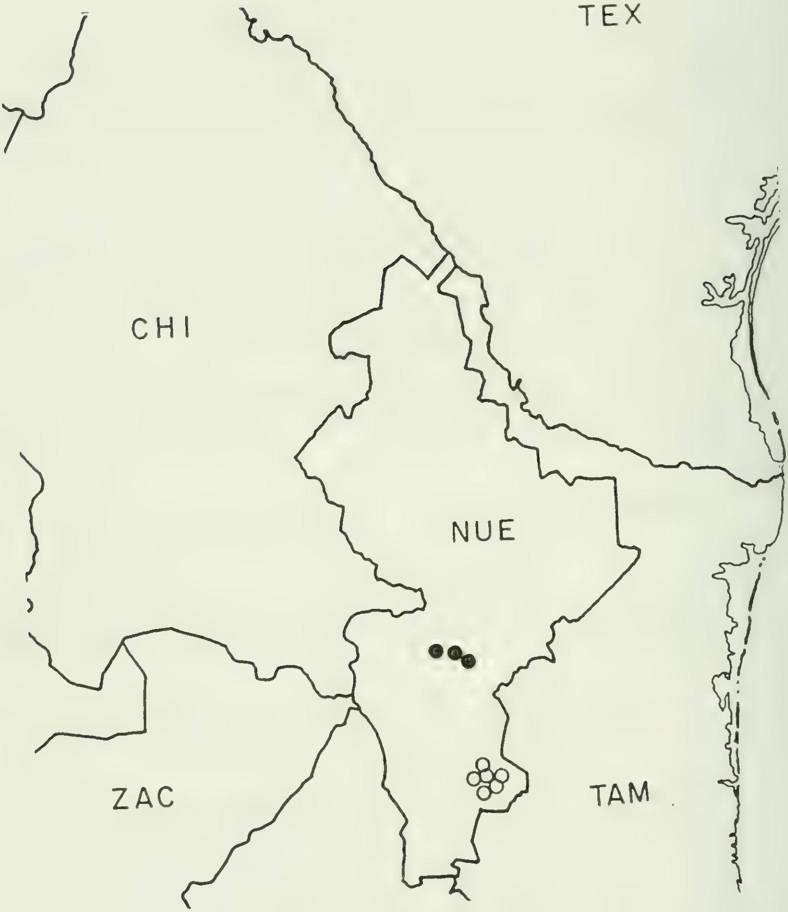

Figure 1. Distribution of varieties of *Perymenium hintoniorum*.

for the hispidulous lobes. Anthers brown. Achenes 3-angled (ray florets) to radially flattened (disk florets), ca. 3 mm long, 1.8 mm wide; pappus of 10-20 deciduous bristles 2-4 mm long.

ADDITIONAL SPECIMENS EXAMINED: MEXICO. Nuevo León: Mpio. Aramberri, S of La Escondida, gypsum hillside, 1820 m, 16 Oct 1993, *Hinton et al. 23596* (TEX); Aramberri to El Salitre, gypsum hillside, 1325 m, 26 Oct 1993, *Hinton et al. 23733* (TEX); road to Dolores (from Aramberri), gypsum hills, 1255 m, *Hinton et al. 23855* (TEX). Mpio. Zaragoza, W of Zaragoza, gypsum hillside, 1460 m, 16 Oct 1993, *Hinton et al. 23645* (TEX); 19 km S of Zaragoza (23° 40′ N, 99° 48′ W), 1950 m, 18 Nov 1993, *Villarreal y Carranza 7560* (TEX).

As indicated in the diagnosis, var. *gypsophilum* is distinguished from the typical variety in having smaller leaves, eglandular peduncles and brown anthers. So far as known, it is confined to gypseous soils of southern Nuevo León (Figure 1).

## ACKNOWLEDGMENTS

I am grateful to Gayle Turner for the Latin diagnosis, and to her and Justin Williams for reviewing the paper.

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# THE NATURAL HISTORY OF SOUTHWESTERN CHIHUAHUA, MEXICO IN THE 1930'S

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## ABSTRACT

A summary of conditions is given for southwestern Chihuahua during the 1930's. This summary is based on the experiences of the author as he lived, worked, and botanized in that area.

KEY WORDS: México, Chihuahua, ecology, historical summary

## RESUMEN

Se presenta un sumario de condiciones del sudoeste de Chihuahua durante la década de los años 1930. Este sumario esta basado en las experiencias del autor durante el período en que vivió, trabajó, y estudió la flora de la región.

PALABRAS CLAVE: México, Chihuahua, ecología, sumario histórico

The Sierra Madre of western Chihuahua has been inhabited for many years by such Indian tribes as the Tarahumaras and the Tepehuanes. The ethnobiology of these tribes has been narrated by various writers such as Bennett & Zingg (1935), and Pennington (1963, 1969). Some prominent nineteenth century biologists who made serious studies there were Edward Palmer (in McVaugh 1956; Robinson & Fernald 1884-1895), Edward Nelson and Major Edward Goldman (Goldman 1951), and certain scientists with the several Carl Lumholtz expeditions (Lumholtz 1902). In this century are the works of Wilmer Tanner in herpetology (Tanner & Robinson, Jr. 1959), Sidney Anderson on mammals (Anderson 1972), and botanists Bailey & Wendt (1979), Bye, Burgess, & Trias (1975), Bye & Soltis (1979), Bye & Constance (1979), Clausen (1975), Correll (1962), Deghan & Webster (1978), Gentry (1942), Knobloch (1942-1983), Lindsay (1943), Mathiasen (1979), Spellenberg (1978), Wiens (1964), and Ayers (1987). The Chihuahuan Desert has been and continues to be investigated intensively, but it is my opinion that the Sierra Madre Occidental which covers much of southwestern Chihuahua, still holds many surprises for the biologist.

I will essentially confine my remarks and observations to the areas around two towns, only dealing casually with other areas where I collected starting in 1937. The first locale is Mojarachic with a latitude of 27° 52′ N, longitude of 107° 55′ W, and an elevation of approximately 6900 feet (2103 m ). The other town is Maguarichic at the same latitude, longitude of about 107° 59′ W, and at an undetermined elevation but approximately 1494 meters. These mining towns were not usually to be found on any map, but I was recently sent the Maguarichic section of a map on the scale of 1:50,000 by Dr. Tina Ayers which shows both places. Both towns are sometimes spelled without the final "c".

Mojarachic boasted only one or two permanent, and no more than 30 temporary families when the silver mine was in operation in the late 1930's. The mine was unprofitable and closed down shortly after I terminated my employment there in 1940 to pursue my doctorate at Iowa State in Ames. I am now able to report that the road to this site is impassable by truck due to washouts. Dr. Tina Ayers is the authority for this late information based on her personal experience. Maguarichic was a silver and gold mine easily reached by horse from Mojarachic (and by car from San Juanito) and there were several thousand persons there with most of the men being employed by the mine. This mine proved to be a huge success and it was believed that ore valued at about $15 million U.S. was extracted in just a short time. Modern maps now show a fine graded road going as far as Maguarichic.

Based on information which I have received from mining experts at the University of Texas--El Paso, the visible rocks are volcanic in origin. The buff-colored surface rock is rhyolite and underneath this type is a bluish andesite in which one usually located the gold and silver-bearing quartz veins. Several miles from Mojarachic I have seen cliffs of basalt. Sedimentary Cretaceous limestone is present in many parts of Chihuahua and is assumed to underlie the andesite mentioned above.

Small streams easily cut into the soft rhyolite and coalesce with others until they eventually drained into the large Río Fuerte which empties into the Gulf of California. The Sierra Madre contains a number of deep canyons (Urique, Cobre, Tararecua, Verde, Oteros, and Batopilas) and the terrain is very rugged indeed. Three of these canyons or barrancas will be mentioned below. Only occasional flat areas can be cultivated and in the 1930's the field workers used home-made wooden plows. As the furrow was made, another worker punched a hole in the furrow, dropped in a seed (fruit) and kicked the earth over the seed or fruit with his foot. Nature was then left to "take her course."

There were few cows to be seen and some ranchers favored goats. My wife and I possessed one female goat which furnished us with an ample supply of delicious milk. For meat we were able to select from several hundred chickens. Our other livestock consisted of a pair of horses, a pair of peacocks, and several turkeys. Our drinking water was carried from a hillside spring and dumped into an oil drum attached to the living quarters with a faucet in the kitchen. The water sometimes contained live salamanders.

Sons were highly prized in our area because they were put to work early and they turned their earnings over to their parents. Health care was almost non-existent. The Maguarichic mine had a small medical facility and their x-ray machine showed that an almost severed finger tip of mine would heal just fine. However, a few days later I noticed that gangrene had set in and a long, hurried trip by car, truck, and train to an El Paso, Texas hospital was imperative. Being before the use of penicillin, the doctor had to extract the poison by using flaxseed poultices and this he did one day short of cutting the arm off at the wrist. The dentist there (in Maguarichic) specialized in pulling teeth, a talent which my wife has always regretted. When the same young lady developed hepatitis, she had to go all the way to El Paso for treatment.

Law enforcement was in its infancy and there were posses going around regularly. Those who could afford to own a gun always carried it when away from their ranchito. Few natives wore eyeglasses or had store furniture because of the cost.

In the 1930's there was an east-west railroad in Chihuahua running from Ojinaga (opposite Presidio, Texas) to Creel. Its name was Kansas City, Missouri, and Orient and there is quite a story connected with its building. The wood-burning train boarded at Chihuahua City by us, was a combination passenger and freight outfit which stopped at every town and hamlet. Consequently, the trip to San Juanito, our destination, sometimes took as long as 22 hours. Children and adults sold food from napkin-covered baskets at almost every stop. Kerosene lanterns swayed from the ceilings of the passenger cars as the train slowly creaked along the worn-out road bed. Some cars had many bullet holes in them. How different it is today. In a remarkable engineering feat, the Mexican government has carried the railroad through very difficult terrain as far as Los Mochis on the Pacific side by means of many tunnels and bridges, thus providing the passengers with spectacular views of Chihuahua's barranca region. Modern lodges and hotels now enable the tourist an opportunity to stay a while and savor the beauty. The new railroad is named Ferrocarril de Chihuahua al Pacifico S.A. de C.V. México.

It is not possible to fully describe the physical features and ecological zones of Chihuahua in this short article; rather the reader can be referred to pages one to five of the book- "*Ferns and Fern Allies of Chihuahua, Mexico*," (Knobloch & Correll 1962) for a summary and the names of well-known students of the subject. It is possible that the above-mentioned book can be purchased at The Bookstore, University of Texas at Dallas, 2601 N. Floyd Rd., Post Office Box 688, Richardson, Texas 75080. Although I did some collecting in the central, more arid areas of Chihuahua, most was done on either side of the Continental Divide. The eastern or Atlantic side of the Divide features eroding mountains with many beautiful, flower-filled meadows in season. The Pacific drainage embraces most of the great barrancas of the state.

The Mojarachic area was in a transition zone of pines and oaks on the Pacific front but there were many other arborescent as well as shrubby taxa such as *Arbutus*, *Ilex*, *Ceanothus*, and *Arctostaphylos*. Although the rains did not start until May, some taxa were in flower in January and February such as *Salix* spp., *Arctostaphylos pungens* H.B.K. *Cupressus arizonica* E. Greene, *Juniperus*, and *Acacia* spp. In March we noted *Ceanothus buxifolius* Willd., *Dalea* cf. *formosa* Torr., *Viola* spp., and *Potentilla knoblochii* Standley, among others. April brought out the blossoms of various oaks, *Gaultheria glaucifolia* Hemsl., *Ilex* cf. *rubra* S. Wats., *Arbutus xalapensis* H.B.K., and *Opuntia* spp. May finds the bracken fern's croziers unrolling and some pines are demonstrating new shoot growth. Many taxa are now coming into flower as we get into July, including *Hypoxis* sp., *Bouvardia glaberrima* Engelm., and *Ipomoea madrensis* S. Wats. The ericaceous *Pterospora andromeda* Nutt. was in flower in August, but my favorite flower, *Milla biflora* Cav. seems to be at its best in September.

As mentioned above, Maguarichic is lower, has less rainfall, is more arid and the vegetation might be called Short-Thorn. The lower slopes and bottoms of the great barrancas can likewise be called Short-Thorn or Tropical Deciduous Forest with large cacti, sizable *Bursera* and fig trees with *Crescentia alata* H.B.K. trees occasionally seen. Where the federal railroad nears the Sinaloa border and, also west of Guadalupe y Calvo the vegetation is semi-tropical or tropical depending on elevation and other factors. Sierra Mohinora, reached from the same town, may be in the Boreal Zone at its summit (about 3200 meters).

It is not possible to describe in this article all of the places I visited in Chihuahua, but it may be useful to some to know that I also examined the plant life in the vicinity of Guachochic (flying out of Cd. Chihuahua, including the Barranca Sinforosa and the area around the town of Guadalupe y Calvo (flying out of Hidalgo de Parral).

The ethnobiology of the region has been dealt with earlier by Bennett & Zing (1935), Pennington (1963, 1969) and lately by Bye, Burgess, & Trias (1975) and will not be discussed here. Modern medicine can still learn about possible uses of native Mexican plants.

In the late 1930's I left Mojarachic where I was employed, for San Juanito by truck, took the old train to Creel, and then proceeded to a mine in the Barranca del Cobre by truck and then by horse. There, as the guest of the late Mr. and Mrs. Zehtner, I spent two weeks exploring this famous canyon. Copper has been mined by various companies there since the late nineteenth century. The barranca is about 3,000 feet (914 m) deep from the top to the mine and it was here that I saw my first *Psilotum* and my first *Ficus*. I also saw my first river otter, an animal which the late Major Edward Goldman of the Smithsonian Institution did not believe occurred there. The natives in the canyon occasionally hunted for them for their valuable fur. The name of the river is the Río Urique, which runs westward until it reaches a hard rock formation at which point it runs south into the Barranca Urique, a deeper canyon than the Copper Barranca.

The depth of the Barranca Urique from the town of Cerocahui at the top, to the town of Urique at the bottom, was estimated to be about 5800 feet (1770 m) by Dr. Sidney Anderson (1972 and pers. comm.). Dr. Anderson's 1972 contribution was on the mammals of Chihuahua. Incidentally, on page 214, Anderson quotes Dr. Villa as saying that Mojarachic is the same place as Maguarachic but this is not correct according to the late map consulted. I have been down in the Barranca Urique twice; the first time was with Dr. Gerald Prescott (in 1954), a well-known algologist. We went in from a trail south of Creel before the new rails were laid. The second trip to the town of Urique was with Dr. Wilmer Tanner, a well-known herpetologist (in 1958).

It is well to add that the entire barranca region is inhabited by the cave-dwelling Tarahumara Indians. At the time of our trips there were said to be about 25,000 members of this tribe. Modern medicine is reaching these taciturn people and will improve their health but putting their men in blue jeans and so forth will probably destroy some aspects of their fascinating life style. Those family groups holding to their ancient customs will farm small areas at the top of the barrancas in the summer and practice their agriculture at the bottom in the cold winter months.

One more barranca should be mentioned, namely that enclosing the Río Batopilas. My main focus was the town of Batopilas where Edward Palmer (American botanist) worked in 1885 (Vasey & Scribner 1886-1887; Watson 1882-1883, 1886 a,b). The rare fern plants I was seeking were *Asplenium modestum* Maxon which I did not find, and *Cheilanthes weatherbiana* R.M. Tryon, which I did find. Lately, Dr. T. Reichstein of Basel, an expert in the genus *Asplenium*, has sent his co-worker Christopher Fraser-Jenkins twice to Batopilas to locate *A. modestum*. At this time, this rarity has not been rediscovered. My trip to this small town was in 1957 by truck from Creel to the Carmen Mine at La Bufa in the Batopilas Canyon, and thence by burro to the town. Now a fine road from Creel enters the town.

Of the 2832 sheets of plants collected by me in México, about 2300 of them were taken in Chihuahua. This is so because of my early residence there in the late 1930's and my later trips sponsored by the NSF to complete copy for the book by the late Dr. Donovan Correll and myself, mentioned earlier. The bulk of my specimens are at MSC, US, F, and MICH, but others are scattered among TEX, SBDG, SMU, WAHL, WIS, PENN, BM, RSA, MO, TAES, RM, MINN, MEXU, ENCB, DS, CHAPA, LL, CSLA, CAN, SD, CU, NY, NA, and UC.

Since my training included many courses in zoology, I could not resist noticing the fauna of a region I knew to be unexplored. Most of this sampling was done in the Mojarachic-Maguarichic region. Holo- and paratypes of a new salamander, *Ambystoma rosaceum* Taylor, were located at Mojarachic (Taylor 1941). This is the same creature we found in our drinking water.

Taylor (1940b) also described the holo- and paratypes of a snake, *Lampropeltis pyromelana* Taylor subsp. *knoblochii* Tanner (as *L. knoblochii*). This was from Mojarachic, as well as a new frog, *Hylactophryne tarahumaraensis* Taylor (as *Eleutherodactylus tarahumaraensis* (Taylor 1940a). Legler (1959) described a new snake, *Geophis aquilonaris* Legler but this has now been reduced to the subspecies level under *G. dugesii* Boucort.

A new species of fern was discovered in Nuevo León (a state in northeastern México) a fern long confused with *Cheilanthes tomentosa* Link. The holotype of this taxon, *C. chipinquensis* Knobloch & Lellinger is at US. *Briquetia inermis* Fryxell was found at La Bufa, s.e. of Creel, Chihuahua with the holotype at ENCB (Fryxell 1976). *Lobelia knoblochii* T. Ayers (Ayers 1987) was recently named with the holotype (F) coming from Mojarachic. *Tillandsia cretacea* L. Smith (at U.S.) came from La Bufa, s.e. of Creel and was described by Lyman Smith (1974). *Solanum citrullifolium* A. Br. var. *knoblochii* M. Whalen was located at the railroad town of San Juanito and named by Whalen in 1976. The last two new taxa came from Mojarachic. One was *Potentilla knoblochii* Standley with holotype at F (Standley 1940). The second was *Quercus knoblochii* C.H. Mull. (1942), probably a hybrid between *Q. coccolobaefolia* Trel. and *Q. viminea* Trel. The holotype is at F.

A list of all my collections is in a storage room in the herbarium at Michigan State University and a copy has been sent to Dr. Bye; the receipt of this list was acknowledged by him. A card file on the flowering plants collected in all of Chihuahua by other collectors was sent to Dr. James Henrickson and the receipt of this was acknowledged by him. Both of these items are potentially useful, but continuing taxonomic refinement of the names will have to be made.

The entire Sierra Madre Occidental, especially in the states of Chihuahua and Durango, can be very fruitful to both zoologists and botanists. Many areas remain to be explored and I especially recommend the southwest corner of Chihuahua near the Sinaloa border.

## ACKNOWLEDGMENTS

I have found the Mexican government officials, the professional staffs of the Mexican universities, and the people I met in the small towns to be both helpful and gracious. I shall always be in their debt.

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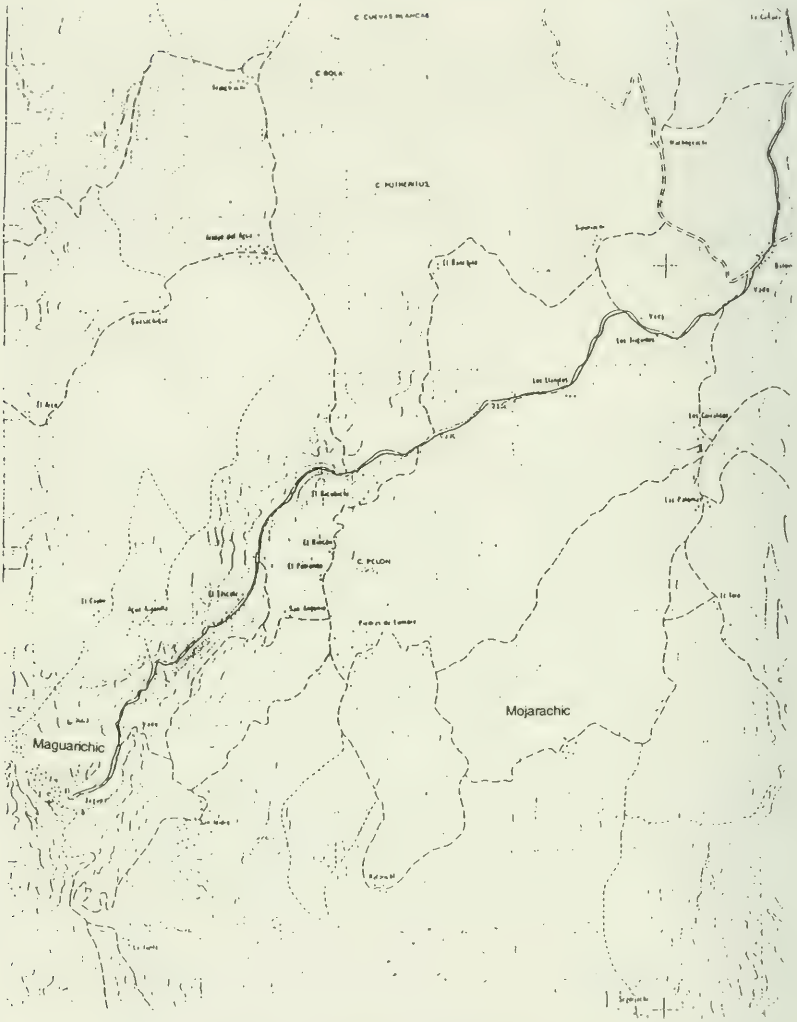

Figure 1. A drawing made in the Geography Department, Michigan State University, of a section of a map produced by the Republic of México, Centenal map (Instituto Nacional de Estadistica Geografía y Informatica, G13 A11, 1979) labeled "Maguarichic" on a scale of 1:50,000 to show the exact location of Maguarichic, Mojarachic, and Segorichic.

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# *CERASTIUM TEXANUM* (CARYOPHYLLACEAE) DOES NOT OCCUR IN TEXAS

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## ABSTRACT

*Cerastium texanum* Britt. is typified by material collected by Charles Wright during the period March-April of 1852, while he was engaged in a Mexican Boundary Survey under the direction of Major W.H. Emory. Britton, in naming the species, apparently thought the collection site, "Hills, Blanco..." [handwritten label data attached to the collection concerned] was in Texas, perhaps in reference to Blanco, Texas, a well known locale in central Texas located in southern Blanco County. The village of Blanco was established in 1853, after Wright collected type material. A careful retracing of Wright's itinerary during his work with the Mexican Boundary Survey suggests that the species was probably collected in north-central México or possibly in closely adjacent New Mexico. Collections of *Cerastium texanum* are unknown from Texas. In addition to clarification of its typification, a map showing its distribution is provided, along with a key and distributional maps for the five species of *Cerastium* currently known to occur in Texas.

KEY WORDS: Caryophyllaceae, *Cerastium*, Texas, México, systematics

*Cerastium* is a relatively large, mostly Eurasian genus with 100 or more described species, some of these widely introduced elsewhere as weeds. According to Correll & Johnston (1970), Texas has seven native and/or introduced species of *Cerastium*, including *C. clawsonii* Correll (now known to be a species of *Linum*: cf. Hartman 1979; Johnston 1990), and *C. texanum* Britt., the latter presumably not occurring in Texas as noted in the above abstract, in spite of statements to the contrary (Correll & Johnston 1970; Good 1984). With these two species removed Texas can now be said to harbor five species of *Cerastium*: *C. axillare* Correll, *C. brachypodum* (Engelm. *ex* A. Gray) B.L. Robins., *C. fontanum* Baumg., (=*C. vulgatum* L. of Correll & Johnston), *C. glomeratum* Thuill., and *C. nutans* Raf.

A key to these five taxa, along with comments upon their occurrence, distribution, and synonymy, follows.

## KEY TO TEXAS *CERASTIUM*

1. Flowers arranged in dense terminal glomerules, their pedicels mostly 1-3 mm long. .......... *C. glomeratum*
1. Flowers not as described in the above, their pedicels mostly 4 mm long or more. .......... (2)
    2. Petals about equal to or shorter than the sepals. .......... (3)
    2. Petals decidedly longer than the sepals. .......... (4)
3. Flowers arising single in the leaf axils along much of the stem; bracts of the inflorescence without scarious margins. .......... *C. axillare*
3. Flowers not as described in the above, mostly arising 2 or more from the leaf axils along the uppermost portions of the stem; bracts of the inflorescence with scarious margins. .......... *C. fontanum*
    4. Leaves along lower portion of stem mostly 3 cm long or less; fruiting pedicels about as long as the capsules, straight or only slightly arcuate or recurved; common in eastern Texas. .......... *C. brachypodum*
    4. Leaves along lower portion of stem mostly 4 cm long or more; fruiting pedicels much longer than the capsules and markedly recurved near their apices; rare species of western Texas. .......... *C. nutans*

*CERASTIUM AXILLARE* Correll, Figure 1.

This taxon occurs in trans-Pecos Texas and closely adjacent México, mostly in shady igneous soils along ledges and seeps from 5000-6000 feet; March-May (September).

*CERASTIUM BRACHYPODUM* (Engelm. *ex* A. Gray) B.L. Robins., Figure 2.
*Cerastium nutans* Raf. var. *brachypodum* Engelm. *ex* A. Gray

*Cerastium brachypodum* is fairly common in east-central Texas, occurring in mostly disturbed calcareous soils; February-April.

Good (1984) recognized this taxon as a distinct species, as did Correll & Johnston (1970), although some workers would treat it as a variety of *Cerastium nutans*, as noted in the above synonymy. *Cerastium nutans* is reportedly "uncommon in Texas", which seems to be the case for I have not examined specimens from the state as noted below, although it is fairly common in México and elsewhere in North America (Good 1984).

*CERASTIUM FONTANUM* Baumg., Figure 3

This is the name applied by European workers to what was formerly referred to as *Cerastium vulgatum* L. It is relatively uncommon in Texas, as indicated in Figure 3.

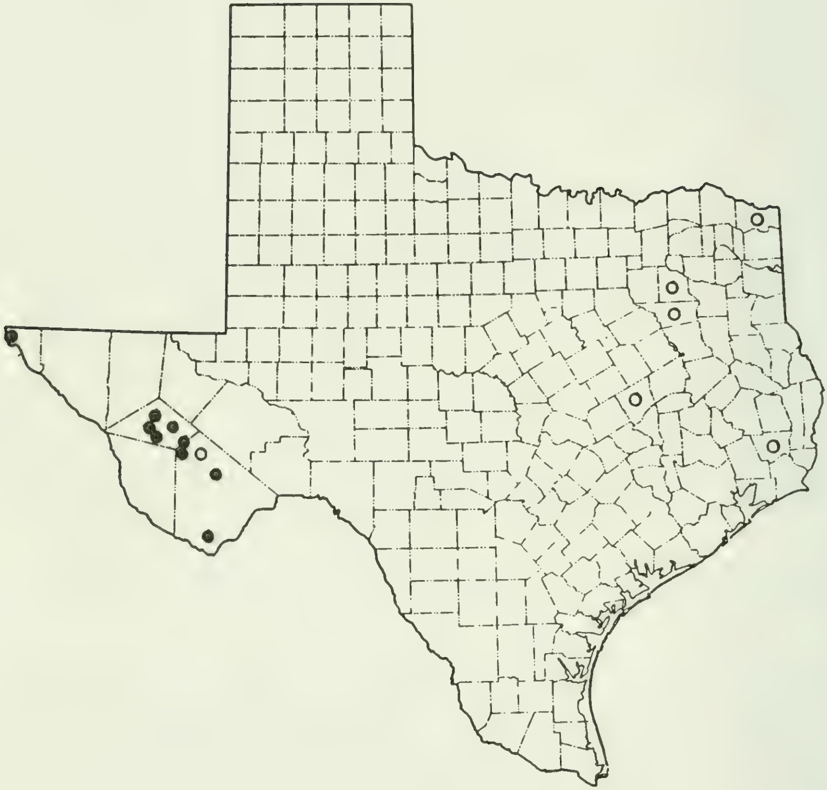

Figure 1. Distribution of *Cerastium axillare* (closed circles) and *C. fontanum* (open circles) in Texas.

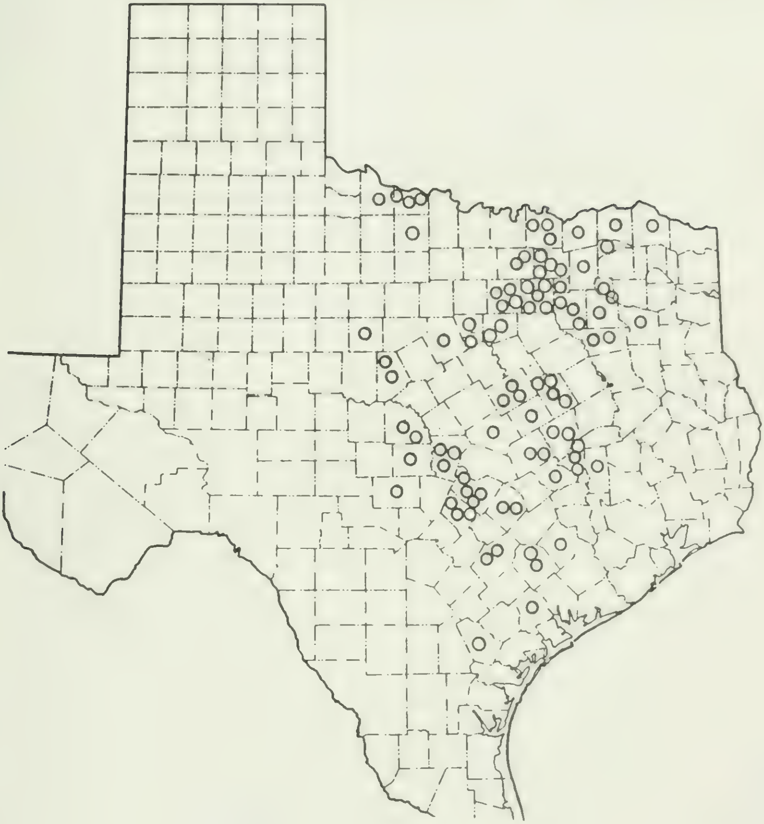

Figure 2. Distribution of *Cerastium brachypodum* in Texas.

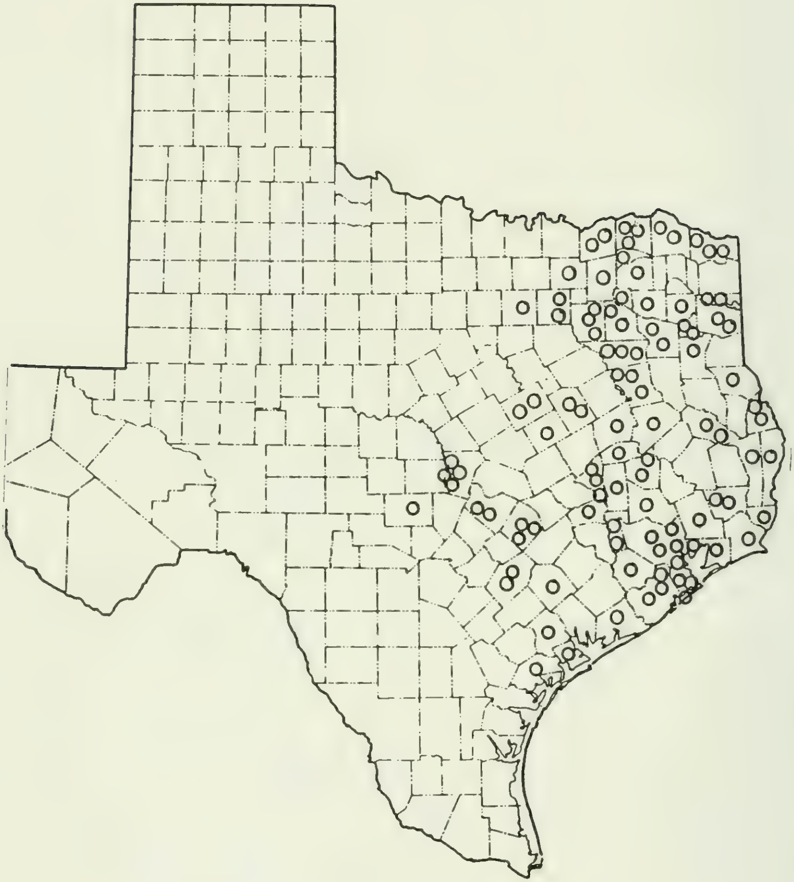

Figure 3. Distribution of *Cerastium glomeratum* in Texas.

## *CERASTIUM GLOMERATUM* Thuill.

This introduced weedy species is typified by material from France (Good 1984) and is a relatively common weed in México and Central America, likewise in eastern Texas.

## *CERASTIUM NUTANS* Raf.

According to Correll & Johnston (1970) this weedy species is common across much of the U.S.A. and parts of México, but is "uncommon in Texas." Indeed, I have not seen collections from the state.

## *CERASTIUM* SPECIES RECOGNIZED FOR TEXAS BY CORRELL & JOHNSTON BUT EXCLUDED FROM THE PRESENT ACCOUNT

*CERASTIUM TEXANUM* Britt., Bull. Torrey Bot. Club 15:97. 1888. TYPE: MEXICO (?). Chihuahua(?). "hills, Blanco", Mar-Apr 1852, *C. Wright 69* (HOLOTYPE: NY!). In the protologue Britton notes that "This very distinct species is represented in the Torrey Herbarium by half a dozen fragments, and does not appear to have been distributed." All of the fragments are mounted on a single sheet, the holotype.

*Stellaria montana* Rose, Contr. U.S. Natl. Herb. 1:93. 1891. TYPE: MEXICO. Sonora: Alamos Mountains, *E.J. Palmer s.n.* (HOLOTYPE: US).

Good (1984) has given an excellent description and account of this taxon, including the above synonymy. Unfortunately he accredited its occurrence in Texas largely to Correll & Johnston (1970), not having seen specimens himself. No doubt he was also misled by the epithet of the species, along with ignorance as to its type locality. When he first described it, Britton applied the name "*texanum*" to the taxon, presumably under the assumption that the type material had been obtained from the hills about Blanco, Texas, or perhaps along the Blanco River of central Texas. But the material concerned, to judge from label data, was probably collected in northern México or New Mexico during April-May, 1852, while Wright was connected with the Mexican Boundary Survey. The village of Blanco, Texas, was not established until 1853 (Webb 1952) and there is no indication that Wright ever collected in the vicinity of this locality. Indeed, from what is known about the distribution of the species, Wright probably collected the type in northcentral Chihuahua during the period 17-23 April, 1852, during a brief side trip to that region out of El Paso, Texas. While detailed field notes from this phase of Wright's journey are lacking (Johnston 1940), one can infer the place or area of likely collection: a Mexican village or watercourse in this area with the name "Blanco". It is also possible, however, that Wright collected the species somewhere in southern New Mexico, for he also was in this area during the period Mar-Apr 1852, and this region also possesses populations of *C. texanum* (as indicated in Figure 4). Johnston (1940) notes that Wright spent the period March-April surveying the Rio Grande from El Paso, Texas to old Fort

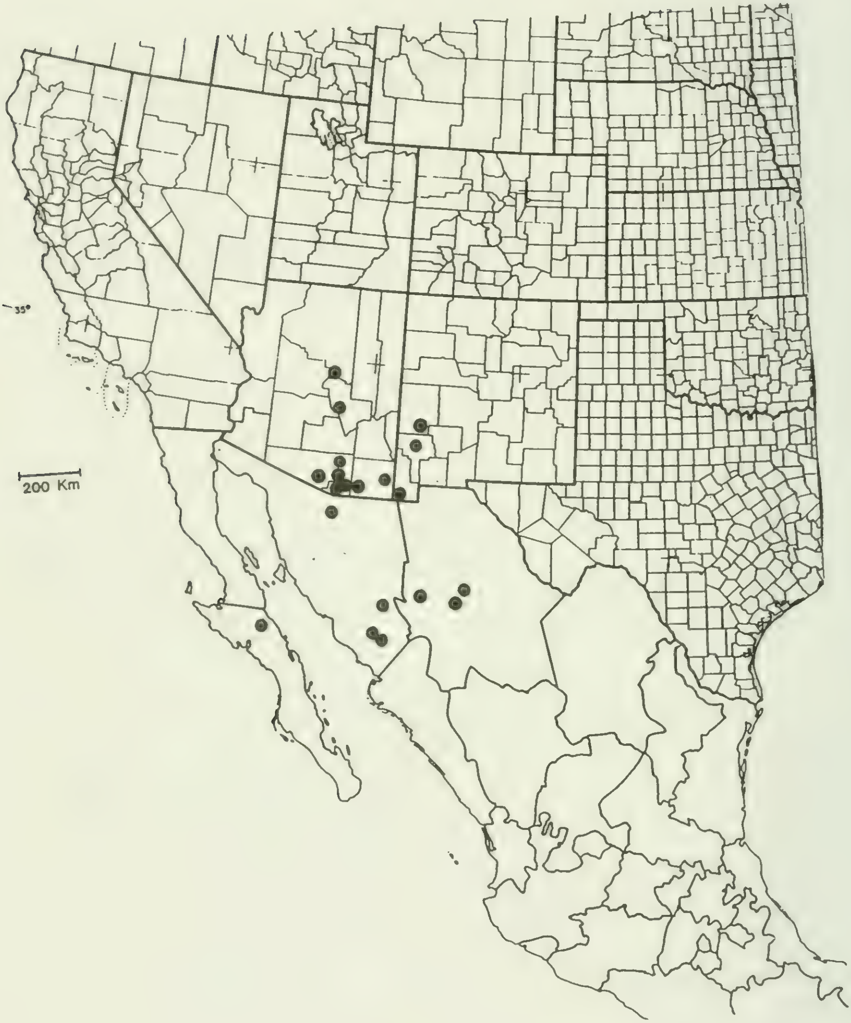

Figure 4. Distribution of *Cerastium texanum*.

Quitman in present day Hudspeth County, Texas, except for the venture to northcentral Chihuahua, México, mentioned in the above account. During the period 29-30 April, however, Wright did collect in the Organ Mountains of New Mexico.

*CERASTIUM CLAWSONII* Correll, Wrightia 4:25.1968.

As first noted by Hartman (1979), this taxon belongs to the genus *Linum* of the family Linaceae where it can by synonymized with *Linum hudsonioides* Planch. When Dr. Ron Hartman (currently at WYO) detected this error, I suggested that he call it to the attention of its author, D.S. Correll, and he did. Correll was not especially admonished by the revelation; indeed, he merely responded to Hartman, cheerfully I imagine, knowing his personality, that someone should set the record straight, but as a lame excuse he added that he was unfortunately misled as to its identity by some careless annotation on the type specimen to the effect that it was a species of *Arenaria*, which he knew it not to be!.

## ACKNOWLEDGMENTS

I am grateful to the following herbaria for the loan of pertinent specimens (BRIT, GH, LL, NY, TEX), and to Ron Hartman for helpful information. Gayle Turner and Ted Delevoryas reviewed the manuscript.

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# TAXONOMY AND NOMENCLATURE OF *SCHKUHRIA PINNATA* (ASTERACEAE, HELENIEAE)

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## ABSTRACT

*Schkuhria pinnata* is treated as having two varieties, one in South America (var. *pinnata*), and one in North America (var. ***wislizeni*** [A. Gray] B.L. Turner, *comb. nov.*). A complete synonymy for the North American elements of *S. pinnata* is given, along with a map showing their distribution.

KEY WORDS: Asteraceae, Helenieae, *Schkuhria*, systematics

*Schkuhria* is a weedy genus of about five species. One of these, *S. pinnata* (Lam.) Kuntze *ex* Thell., is a widespread highly variable weedy species of North and South America, which has received varying taxonomic treatments. The species is typified by elements from South America and plants from that continent, if treated as a single infraspecific taxon, are properly called var. *pinnata*. The North American elements of *S. pinnata* have received numerous treatments and epithets, and these are largely accounted for by Rydberg (1914), Heiser (1945), Blake (1951) and McVaugh (1984). McVaugh, in particular, has presented a masterful account of *S. pinnata* in his treatment for the flora of Novo-Galiciana, recognizing two varieties, as follows:

1. Involucral bracts mostly dark red or purplish throughout (rarely not); hairs on angles of achenes 0.6-1.8 mm long. .................... var. *guatemalensis*
1. Involucral bracts mostly green (sometimes the upper 1/3 reddish); hairs on angles of achenes 0.3-0.6 mm long.................................. var. *virgata*

For the reasons given below, I can recognize but a single varietal taxon of *Schkuhria pinnata* in North America, this being ***Schkuhria pinnata*** (Lam.) Kuntze *ex* Thell. var. ***wislizeni*** (A. Gray) B.L. Turner, *comb. nov.*, based upon *Schkuhria wislizeni* A. Gray, Mem. Amer. Acad. Sci. 4:96. 1849. The purpose of the present paper, then, is to account for the synonymy of the two varieties recognized by McVaugh, and to justify the synonymizations of all of the formal infraspecific epithets of North America with the earliest available varietal epithet, var. *wislizeni*.

*SCHKUHRIA PINNATA* (Lam.) Kuntze *ex* Thell., Repert. Sp. Nov. 11:308. 1912.

*SCHKUHRIA PINNATA* (Lam.) Kuntze *ex* Thell. var. *GUATEMALENSIS* (Rydb.) McVaugh, Contr. Univ. Michigan Herb. 9:443. 1972.
*Hopkirkia anthemoidea* DC.
*Schkuhria anthemoidea* (DC.) Coult. var. *guatemalensis* (Rydb.) Heiser
*Schkuhria anthemoidea* (DC.) Coult. var. *wrightii* (A. Gray) Heiser
*Schkuhria guatemalensis* (Rydb.) Standl. & Steyerm.
*Schkuhria hopkirkia* A. Gray
*Schkuhria pinnata* (Lam.) Kuntze *ex* Thell. var. *guatemalensis* (Rydb.) McVaugh
*Schkuhria wislizeni* A. Gray var. *wrightii* (A. Gray) S.F. Blake
*Schkuhria wrightii* A. Gray
*Tetracarpum guatemalense* Rydb.
*Tetracarpum wrightii* (A. Gray) Rydb.

*SCHKUHRIA PINNATA* (Lam.) Kuntze *ex* Thell. var. *VIRGATA* (Llave) Heiser, Ann. Missouri Bot. Gard. 32:271. 1945.
*Mieria virgata* Llave
*Schkuhria anthemoidea* (DC.) Coult. var. *wislizeni* (A. Gray) Heiser
*Schkuhria anthemoidea* (DC.) Coult. var. *wislizeni* f. *flava* (Rydb.) Heiser
*Schkuhria pringlei* S. Wats.
*Schkuhria pinnata* (Lam.) Kuntze *ex* Thell. var. *virgata* f. *pringlei* (S. Wats.) Heiser
*Schkuhria virgata* (Llave) DC.
*Schkuhria wislizeni* A. Gray
*Schkuhria wislizeni* A. Gray forma *flava* (Rydb.) S.F. Blake
*Schkuhria wislizeni* A. Gray var. *frustrata* S.F. Blake
*Tetracarpum anthemoideum* (DC.) Rydb.
*Tetracarpum flavum* Rydb.
*Tetracarpum pringlei* (S. Wats.) Rydb.
*Tetracarpum wislizeni* (A. Gray) Rydb.

As shown in Figure 1, when mapped (mostly using achenal pubescence, *cf.* Figure 2), the two taxa recognized by McVaugh have essentially identical distributions. Indeed, varying intermediates between the two extremes occur (so annotated at LL, TEX) and occasional specimens will have typical forms of each mounted upon the same sheet, suggesting that all of these represent but a single variable species. McVaugh (1984) also commented upon this phenomenon noting that in Nueva Galicia these two extremes "are scarcely separable but seem to have somewhat different habitat-preferences and different geographical extremes. They were maintained as different species by Rydberg (1914) and Heiser (1945) but the characters by which they are separated vary and recombine so capriciously that it may be unrealistic to maintain them at the level of varieties." However, I was unable to document the existence of habitat preferences for the two forms, nor could I infer any difference in their geographical extremes in North America as shown in Figure 2, consequently I have no hesitancy in treating these as but variable elements of a wide-ranging polymorphic species, as McVaugh suspected might be the case.

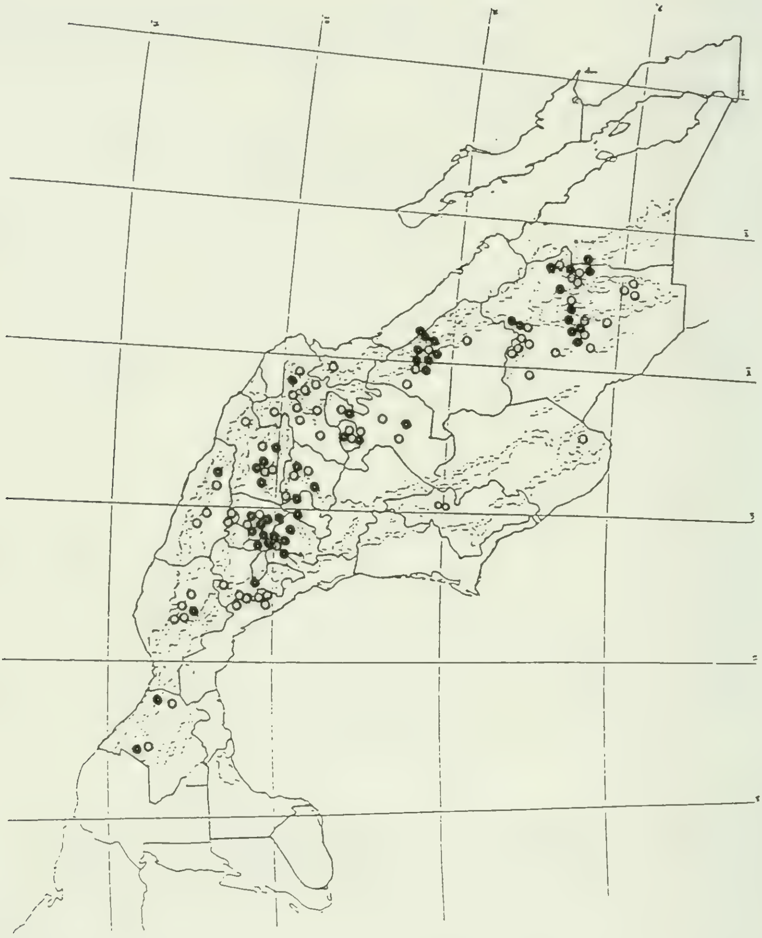

Figure 1. Distribution of achenal forms or "varieties" of *Schkuhria pinnata* (sensu McVaugh 1984) in México: var. *guatemalensis* (open circles) and var. *virgata* (closed circles). Numerous intermediates are treated as one or the other, according to length of the achenal hairs as given in McVaugh's key.

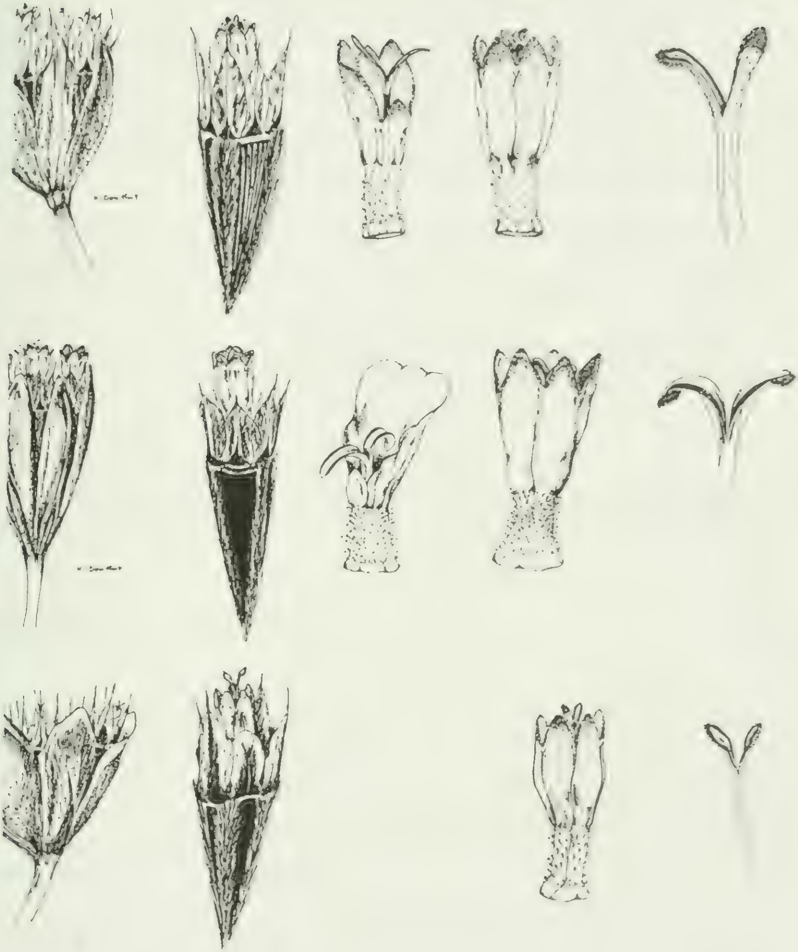

Figure 2. Head and floret variation in *Schkuhria pinnata* var. *wislizeni*. Upper row, left to right, head, achene ray floret, disk floret, style branches of disk floret (*Pringle 13566* [LL]); middle row (*Ellison 20* [TEX]); lower row (with ray florets absent, *Pringle 13567* [TEX]).

The North American populations and or individuals of *Schkuhria pinnata* are very similar to those of South America, but can be readily distinguished from the latter by possessing mostly shorter elliptic-ovate ligules (0.5-1.0[-3.0] mm long, vs. linear and 2.0-4.0 mm long) and achenes with mostly very pubescent angles (vs. weakly pubescent to nearly glabrous). If a single varietal name is to be applied to the North American elements the correct name must be *S. pinnata* var. *wislizeni* (A. Gray) B.L. Turner, as noted above. Heiser (1945) treated all of the North American infraspecific categories which he recognized as belonging to *S. anthemoidea*, this based upon an inadequate interpretation of the type of the latter, as noted by Blake (1951).

*Schkuhria pinnata* var. *pinnata*, so far as known, is confined to South America, but the occasional waif or garden weed of var. *pinnata* has been collected in the northeastern U.S.A. (*e.g.*, Milton, Mass., *Kidder s.n.* [LL]). The var. *wislizeni* is confined to North America, so far as known.

The present study is based upon a large suite of collections at LL., TEX (200+ sheets), all of these appropriately annotated, both as to variety and forma.

## ACKNOWLEDGMENTS

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# A NEW SPECIES OF *VIGUIERA* (SUBGENUS *AMPHILEPIS*) FROM MEXICO, WITH OBSERVATIONS ON ITS RELATIONSHIP TO THE GENUS *TITHONIA* (ASTERACEAE)

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## ABSTRACT

A new species, ***Viguiera ayutlana*** B.L. Turner, is described from Jalisco, México. It apparently belongs to the subgenus *Amphilepis* of *Viguiera* but shares one or more characters with the genus *Tithonia*, suggesting that these two taxa are very closely related, if not the same.

KEY WORDS: Asteraceae, Heliantheae, *Viguiera*, *Tithonia*, México, systematics

Preparation of a treatment of the Heliantheae of México has occasioned the present paper.

***VIGUIERA AYUTLANA*** B.L. Turner, *spec. nov.* TYPE: MEXICO. Jalisco: "Roadsides at edge of cornfield in fir forest area about 28 road miles west of Ayutla, and about 70 miles northwest of Autlan", ca. 6700 ft, 3 Nov 1962, *A. Cronquist 9791* (HOLOTYPE: TEX!).

Similis *V. excelsae* (*V. excelsa*) (Willd.) Benth. & Hook., sed pedunculis valde fistulosis tantum sub capitulis et receptaculis valde conicis (vice receptaculorum convexorum).

Shrub ca. 2 m high. Stems purplish, moderately to sparsely hirsute with bent hairs 0.8-1.5 mm long. Leaves alternate, those on primary stems mostly 15-30 cm long, 4.5-12.0 cm wide; petioles 1.5-4.0 cm long, gradually tapering upon the blades; blades ovate to ovate-elliptic, moderately pubescent above and below, the lower surfaces prominently 3-nervate somewhat above the base, the margins crenate. Heads mostly single and axillary along the upper stems, 6-8 cm across the extended rays. Peduncles 4-14 cm long, markedly swollen and fistulose just below the heads. Involucres hemispheric, 12-14 mm high, ca. 30 mm wide (pressed), the bracts 3-4 seriate, graduate, broadly ovate to broadly elliptic, the inner series loose and somewhat

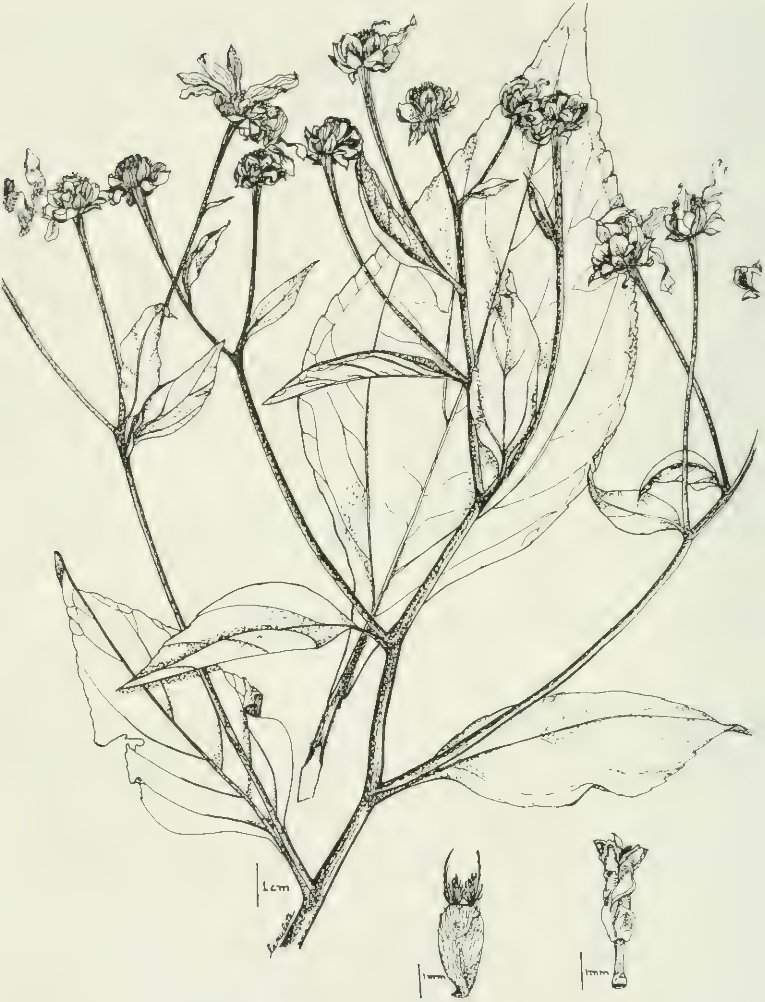

Figure 1. *Viguiera ayutlana*, from holotype.

scarious with broadly rounded apices, the margins weakly ciliate. Receptacle conical, 3-4 mm high, 2-3 mm across; bracts linear-oblanceolate, shorter than the subtended florets, their apices cuspidate. Ray florets 13-18, neuter, sterile; ligules yellow 25-32 mm long, 5-9 mm wide, 16-21 nervate, the apices inconspicuously 2-3 lobed. Disk florets numerous, perfect, fertile; corollas yellow, ca. 4 mm long; tube ca. 1 mm long; limb ca. 3 mm long, markedly pubescent at its base, the lobes ca. 0.8 mm long. Anthers black, the apices ovate. Style branches flat, their apices ovate, glabrous. Achenes radially compressed, ca. 3 mm long, 1.3 mm wide, black, the pappus of 2 lateral awns 1-2 mm long, between these 4-6 fimbriate scales ca. 1 mm long.

Cronquist, who collected type material, identified this taxon as "*Viguiera* aff. *excelsa* (Willd.) Benth. & Hook.", which it superficially resembles. Upon first examining the holotype (in 1987) I annotated this as a possible hybrid between *Viguiera hypochlora* S.F. Blake and some species of *Tithonia*. La Duke (by annotation, 1980), having examined this in connection with his treatment of *Tithonia*, took the plant to be an "unusual" collection of *V. excelsa*. It is an enigmatic collection, for it has enlarged fistulose peduncles like those of *Tithonia*; achenes with a pappus like those of *Viguiera*; receptacular bracts like *Tithonia*; but a markedly conical receptacle, unlike either of the two genera. In the former characters it more or less bridges the gap between *Tithonia* and subgenus *Amphilepis* of *Viguiera* and almost certainly argues for a close relationship of these two taxa. In this connection it must be noted that John Strother recently called to my attention that *Viguiera subcanescens* S.F. Blake of the subgenus *Amphilepis* is almost certainly a synonym of *Tithonia longiradiata* (Bertol.) S.F. Blake, this not accounted for by La Duke in his revisionary study. Finally, there is a remarkable resemblance of the leaves, achenes, and corolla of the latter with *Viguiera ayutlana* (*cf.* Figures 52-54 in La Duke 1982); no doubt the presence of a viguieroid pappus keeps the latter out of *Tithonia*.

*Viguiera* (s.l.) is in much need of detailed DNA study and I surmise that it will have to ultimately include *Tithonia*, unless drastic generic splintering of the complex is preferred, in which case it is still likely that *Amphilepis* will reside within, or next to, *Tithonia*.

## ACKNOWLEDGMENTS

I am grateful to Gayle Turner for the Latin diagnosis, and to her and Ted Delevoryas for reviewing the manuscript.

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# REDISCOVERY OF *SOLANUM INCOMPLETUM* DUNAL (SOLANACEAE) ON THE U.S. ARMY'S POHAKULOA TRAINING AREA, HAWAII

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## ABSTRACT

A federally endangered plant species, *Solanum incompletum* Dunal, was "rediscovered" on the U.S.–Army's Pohakuloa Training Area, Hawaii. On 19 January 1996, nine adults and two seedlings of *S. incompletum* were found growing in a *Myoporus sandwicense* A. Gray dominated shrubland at an elevation of approximately 1425 m. Consumption by feral ungulates (sheep and/or goats) is the major threat to the continued existence of this population, and each adult plant had been severely browsed. The location of the population on a nearly inaccessible margin of the installation makes impact by military activities highly unlikely.

KEY WORDS: *Solanum*, Hawaii, endangered species, extinction

The U.S. Army's Pohakuloa Training Area (PTA) (Figure 1) is a 44,100 ha installation located in the saddle region between Mauna Kea and Mauna Loa on the island of Hawaii. Approximately one-half of the installation is ordnance impact area, and the remaining lands are used for maneuver training by the Army's 25th Infantry Division (Light), Marine's 1st Expeditionary Brigade, National Guard, Army Reserves, and occasionally by allied troops. Shaw *et al.* (1990) reported that approximately 4% of the installation outside of the impact area has been disturbed by military training. Most of the installation has not been impacted by military activities because rugged terrain makes much of the area inaccessible. Major disturbances which result in greatly reduced vegetative ground cover are typically limited to undeveloped roads, frequently used bivouac sites, and fixed artillery firing points.

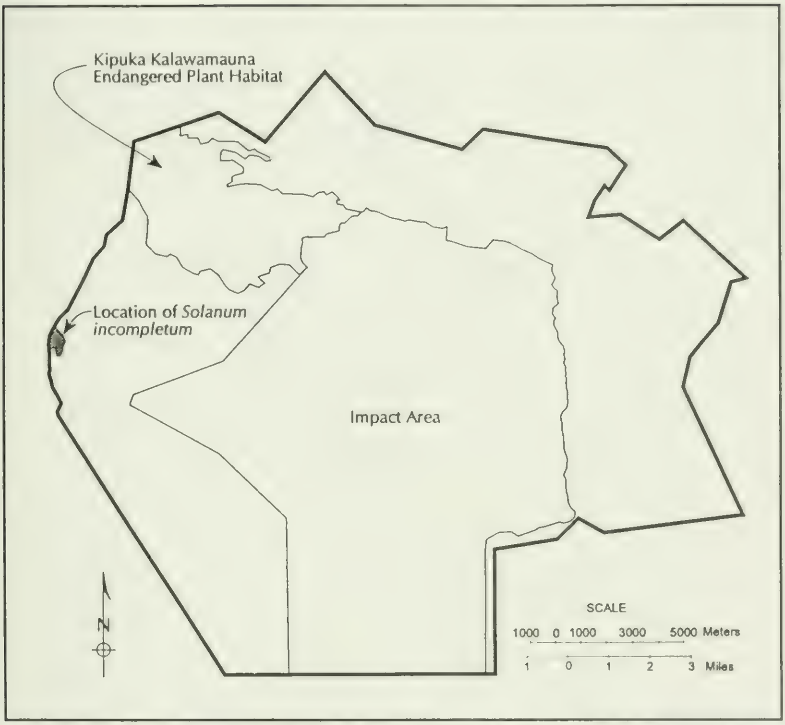

**Figure 1.** U.S. Army's Pohakuloa Training Area, Hawaii, Hawaii with large ordnance impact area, endangered plants habitat, and location of "rediscovery" site of *Solanum incompletum* Dunal.

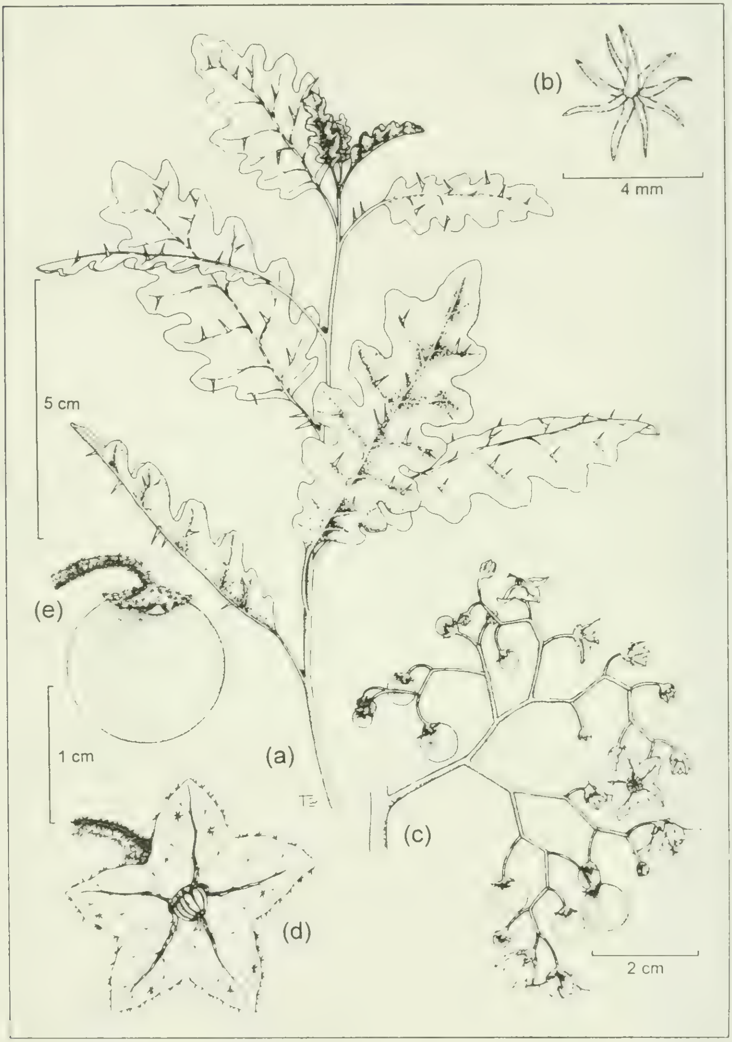

**Figure 2.** Line drawing of *Solanum incompletum* Dunal. a. habit, b. stellate hair, c. inflorescence, d. flower, e. fruit [(a & b from *C.N. Forbes ns*, Kona, Hawaii, 23 June 1923 (BISH); c & e from *J.F. Rock ns*, Puu Ikaaka, Hawaii, Feb 1912 (BISH), d from *G.C. Munro ns*, Kaiholena, Lanai, 30 March 1919 (BISH)].

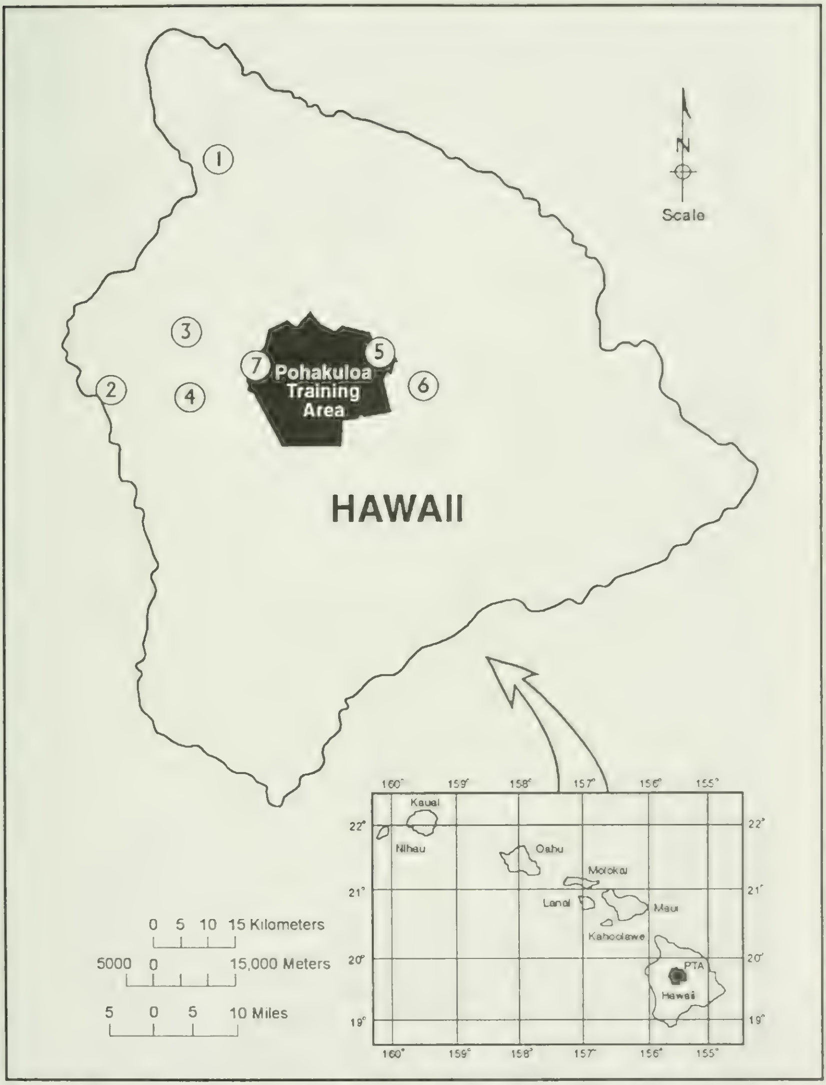

**Figure 3.** Reported locations of *Solanum incompletum* Dunal. on the island of Hawaii: (1) Kawaihae, (2) Kona, (3) Puu Waawaa, (4) Puu Ikaaka, (5) Puu Omaokaii, (6) Puu Huluhulu and (7) new site at Pohakuloa Training Area.

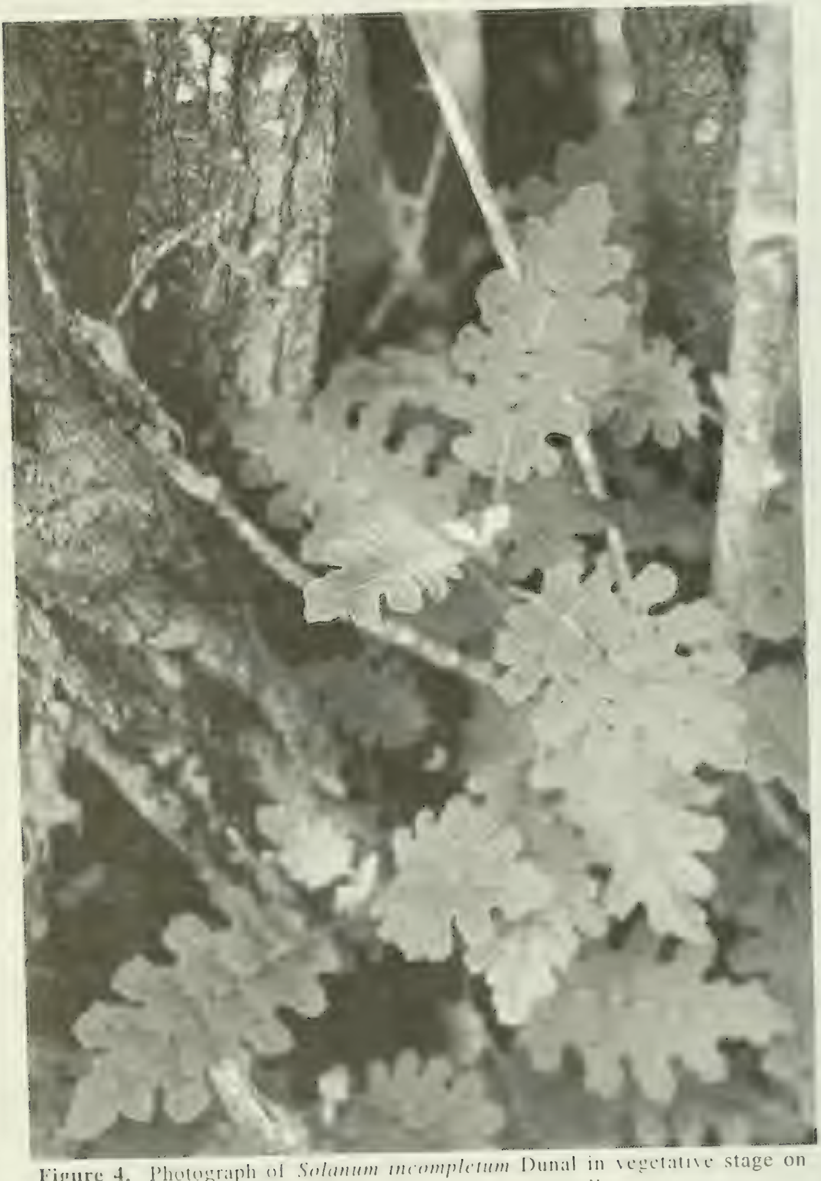

**Figure 4.** Photograph of *Solanum incompletum* Dunal in vegetative stage on the U.S. Army's Pohakuloa Training Area, Hawaii, Hawaii.

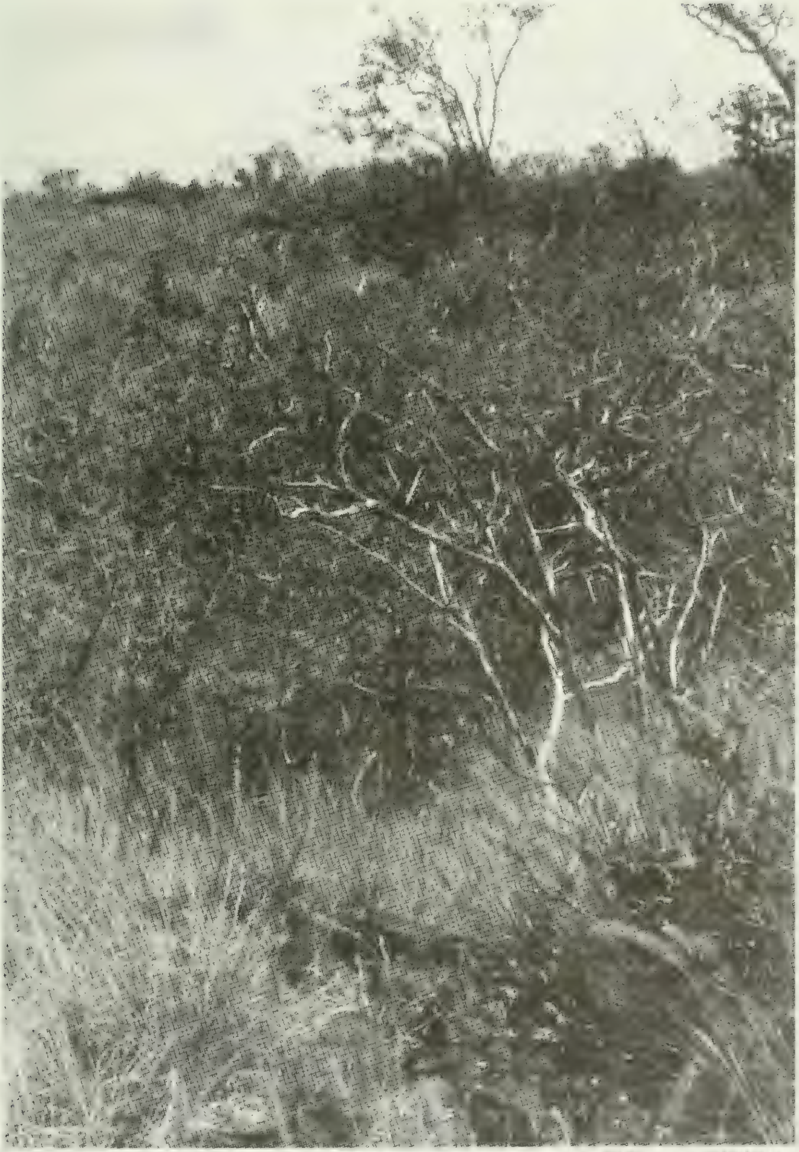

Figure 5. Photograph of *Myoporum* shrubland on approximately 5000 year old Mauna Loa Pahoehoe lava flow which is typical of the area where *Solanum incompletum* was found on the U.S. Army's Pohakuloa Training Area, Hawaii, Hawaii

Castillo *et al.* (1995) described and mapped 24 plant communities on the installation and identified four major associations. First, barren lava and disturbed areas with little or no ground cover compose about 12,475 ha. Second, treelands dominated by *Metrosideros polymorpha* Gaud., *Chamaesyce olowaluana* (Sherff) Croizat & Degener, and *Myoporum sandwicense* A. Gray constitute nearly 14,300 ha of the installation. Third, shrublands comprise 15,700 ha and have the greatest diversity of communities. Dominant shrubs are *Myoporum sandwicense, Sophora chrysophylla* (Salisb.) Seem., *Styphelia tameiameiae* (Cham. & Schlechtend.) F.v. Muell., *Dodonaea viscosa* Jacq., and *Chenopodium oahuense* (Meyen) Aellen. Fourth, native (*Eragrostis atropioides* Hillebr.) and introduced [*Pennisetum setaceum* (Forssk.) Chiov.] grasslands make up the remaining 1625 ha. Some of the largest relatively undisturbed, dry montane treelands, shrublands, and grasslands found on the island of Hawaii occur in the saddle region including PTA (Gagne & Cuddihy 1990; Tierney *et al.* 1996).

Shaw & Douglas (1996) listed over 250 taxa from 70 families and 175 genera of vascular plants from the installation. As floristic surveys and vegetative studies continue, species not previously reported from the installation are continually collected, verified, and added to the species list. Numerous rare plant species have been reported from the installation. Federally listed endangered species verified from the installation are: *Asplenium fragile* C. Presl. var. *insulare* Morton (Bruegmann *et al.* 1994), *Haplostachys haplostachya* (A. Gray) St. John (Herbst & Fay 1979), *Hedyotis coriacea* Sm. (Herbst *et al.* 1992a), *Portulaca sclerocarpa* A. Gray (Mehrhoff 1994), *Silene lanceolata* A. Gray (Herbst *et al.* 1992b), *Spermolepis hawaiiensis* Wolff (Canfield *et al.* 1994; J. Lau, pers. comm.), *Stenogyne angustifolia* A. Gray (Herbst & Fay 1979), *Tetramolopium arenarium* (A. Gray) Hillebr. (Douglas *et al.* 1989; Mehrhoff 1994), and *Zanthoxylum hawaiiense* Hillebr. (Mehrhoff 1994). The Kipuka Kalawamauna endangered plants habitat area (Figure 1) was cooperatively designated by the U.S. Army, U.S. Fish & Wildlife Service, and State of Hawaii Division of Land and Natural Resources primarily for the protection of the first two endangered species found on PTA (*H. haplostachya* and *S. angustifolia*). One federally listed threatened species, *Silene hawaiiensis* Sherff (Mehrhoff 1994), occurs on PTA. *Neraudia ovata* recently was verified from the installation and has been proposed as an endangered species (Bruegmann 1995). The following taxa from PTA are considered species of special concern: *Chamaesyce olowaluana, Eragrostis deflexa* Hitchc., *Exocarpos gaudichaudii* A. DC, *Festuca hawaiiensis* Hitchc., *Hesperocnide sandwicensis* (Wedd.) Wedd., *Portulaca villosa* Cham., *Tetramolopium consanguineum* (A. Gray) Hillebr., and *T. humile* (A. Gray) Sherff subsp. *humile* var. *sublaeve* Sherff. Specimens from PTA once reported as *T. lepidotum* (Less.) Sherff are being described as a new species (T. Lowrey, pers. comm.).

The purposes of this paper are to: (1) report the "rediscovery" of the endangered species *Solanum incompletum* Dunal (Canfield *et al.* 1994), (2) document its occurrence on PTA and (3) delineate current and/or potential threats to this endangered species.

*Solanum incompletum* is reported to be a shrub to 3 m in height (Symon 1990). In the PTA populations, the plant appears to be suckering from the base after being browsed by feral ungulates; thus, it appears suffrutescent and only slightly woody. St. John (1969) also reported that *S. incompletum* suckers and has strong vegetative shoots. There are a few dead stems 5 to 7 dm in height remaining on a single individual. The plants are armed with stout reddish prickles nearly 5 mm in length, and they occur on both surfaces of the leaves and on the stem (at least on new growth) (Figure 2). The leaves are simple, alternate, and elliptical with variously lobed margins. In the plants at PTA, prickles occur on the petioles, mid-rib and prominent lateral veins on both leaf surfaces. Leaf venation, particularly on the undersurface, is prominent. Also, new growth is pubescent with prominent yellowish stellate hairs. Symon (1990) reported, and examination of herbarium material shows, that the species has perfect, regular-shaped flowers borne in simple to compound cymes. None of the plants we observed in the field were in flower or fruit. Symon (1990) described the fruit as a berry which probably is yellow and ripens to black. He suggested that the fruit may not be produced often and that plants and/or flowers may be self-incompatible. We observed, however, young seedlings with long linear cotyledons germinating in proximity to adult plants.

Hillebrand (1888) distinguished two varieties. *Solanum incompletum* var. *mauiense* Hillebr. was segregated based on larger leaves, while *S. i.* var. *glabratum* Hillebr. was separated because the mature leaves were glabrate. Also, St. John (1969) named a separate but related species (*S. haleakalaense* St. John) from Maui based on leaf shape and abundance of prickles. In the latest treatment of the Solanaceae of Hawaii, however, Symon (1990) placed *S. haleakalaense* in synonymy and did not recognize any subspecific taxa because of incomplete collections and taxonomic difficulties with the genus (Canfield *et al.* 1994).

*Solanum incompletum* was first collected on Hawaii by Nelson in 1779 and has subsequently been found on Kauai, Molokai, Lanai, and Maui (St. John 1978; Symon 1990). On the island of Hawaii, the species was known from Kohala Mountains, Kona, Puu Waawaa, Puu Ikaaka, Puu Omaokoili (on PTA), and Puu Huluhulu (Canfield *et al.* 1994) (Figure 3). The last reported sighting of this species was from Puu Huluhulu where two individuals were found forty-five years ago growing at 2040 m in an *Acacia koa* A. Gray and *Sophora chrysophylla* mesic forest (Canfield *et al.* 1994). The PTA locations lie between Puu Waawaa and Puu Omaokoili/Puu Huluhulu (Figure 3). Symon (1990) described the elevational range of *S. incompletum* from 300 m to 2040 m. Historical habitats varied from dry mesic forest to diverse mesic forest and finally to subalpine forests.

*Solanum incompletum* was "rediscovered" on PTA on 19 January 1996 by Close & Schnell. Nine adult individuals are growing at the base of several *Myoporum sandwicense* shrubs. The *S. incompletum* plants have from one to three stems per individual, but when first seen were only 3 dm or less in height because of browsing by feral sheep and goats. As previously mentioned, the plants appear much more herbaceous than shrubby (Figure 4). Also, two germinating seedlings, identified by the characteristic red prickles, are establishing under *M. sandwicense* and indicate that viable seeds must have been produced at some time.

The *Solanum incompletum* individuals occur in a kipuka (*i.e.*, older usually vegetated flow surrounded by younger less vegetated flows forming pockets or islands of vegetation) which supports a *Myoporum* shrubland at an elevation of approximately 1425 m (Figure 5). The shrubland is on a relatively old [5000 years before present (ybp)] Mauna Loa pahoehoe lava flow which subsequently was surrounded by younger Mauna Loa aa flows (4200 ybp). Multi- or occasionally single-stemmed *Myoporum sandwicense* shrubs averaging about 3 m in height dominate the site.

Other woody species in the immediate area are *Myrsine lanaiensis* Hillebr. and *Sophora chrysophylla*. The understory is dominated by "weedy" alien species and indicative of areas over utilized by feral ungulates. Numerous trails, animal droppings, wool or hair entangled in branches, and bones from dead animals all indicate heavy use of the area by feral sheep and goats. Associated understory species include *Solanum pseudocapsicum* L., *Marrubium vulgare* L., *Pennisetum setaceum*, *Asclepias physocarpa* (E. Meyer) Schlecter, and *Kalanchoe tubiflora* (Harv.) Raym.-Hamet.

Canfield *et al.* (1994) discussed threats to *Solanum incompletum* at the time it was listed as endangered. They indicated that the major threats were: (1) reduced number of individuals and populations which increases the potential for extinction from stochastic events; (2) correlated with the first threat is over-utilization for commercial, recreational, scientific, or educational purposes because of low numbers; and (3) competition from the alien plant species *Senecio mikanioides* Otto *ex* Walp. at Puu Huluhulu. They did not indicate that feral animals were a threat because the only known extant population at the time of listing was already fenced to protect the area.

On PTA browsing by feral animals represents an immediate threat to the continued existence of the species at this location. Although the plant is covered with prickles, feral sheep and/or goats appear to relish it. The area in which the population occurs should be immediately fenced to protect the species; or at the very least, individual plants should be caged in order to allow them to flower and potentially produce viable seeds for propagation. Threats to *Solanum incompletum* by military training at PTA are almost non-existent. Accessibility to the area is very difficult and easily controlled. There are no roads within the area, thus dust from military vehicles does not represent a threat. The possibility of accidental fire from military ordnance, obscurants, etc. is remote because the species occurs approximately 5 km from the nearest boundary of the ordnance impact area.

## ACKNOWLEDGMENTS

We wish to thank the military and civilian personnel at the U.S. Army's Pohakuloa Training Area, Hawaii for their continued assistance and interest in protecting the nation's natural resources. The assistance and access to specimens at the B.P. Bishop Museum (BISH) is appreciated. Thanks to Tracy Wager for her excellent illustration. This work was partially funded by the U.S. Army Garrison-Hawaii, Pacific Ocean Division of the U.S. Army Corps of Engineers, LEGACY Resource Management Program, and the U.S. Forest Service's Rocky Mountain Forest and Range Experiment Station. The manuscript was reviewed by Drs. Tracy M. Halward and Richard D. Laven.

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# NOTULAE DE RANUNCULACEIS SINENSIBUS (XX)

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## ABSTRACT

***Delphinium pseudoyunnanense*** W.T. Wang & M.J. Warnock, ***D. kansuense*** W.T. Wang var. ***villosiusculum*** W.T. Wang & M.J. Warnock, and ***Thalictrum simaoense*** W.T. Wang & G. Zhu are described as new. New combinations are provided for ***Delphinium shawurense*** W.T. Wang var. ***pseudoaemulans*** (C.Y. Yang & B. Wang) W.T. Wang, ***D. delavayi*** Franch. var. ***baoshanense*** (W.T. Wang) W.T. Wang, ***D. umbrosum*** Hand.-Mazz. var. ***drepanocentrum*** (Bruhl) W.T. Wang & M.J. Warnock, ***Batrachium trichophyllum*** (Chaix *ex* Villars) Bosche var. ***jingpoense*** (G.Y. Chang *et al.*) W.T. Wang, and ***Ranunculus*** sect. ***Stenoglossa*** (W.T. Wang) W.T. Wang. These new taxa and new combinations are necessary to facilitate ongoing study of the Flora of China.

KEY WORDS: Ranunculaceae, *Batrachium, Delphinium, Ranunculus, Thalictrum*, China, systematics, flora

The following new taxa and new combinations have been brought to light by ongoing work on the Flora of China.

***Delphinium pseudoyunnanense*** W.T. Wang et M.J. Warnock, *spec. nov.* TYPE: CHINA. Yunnan : Between Tengchong and Longling

( 龙陵 ), on banks of road, common only beyond Nan Kao Chai, fl. pale lavender purple, 15 Sep 1922, *J.F. Rock 6551* (HOLOTYPE: GH).

*Delphinium yunnanense* auct non (Franch.) Franch.: Munz, J. Arnold Arb. 48:543. 1967, p.m.p., quoad *Rock 6551.*

Herba perennis. Caulis 1.5 m? altus, parte inferna ignota, superne glaber, ramosus. Folia caulina superna longuiscule vel breviter petiolata; laminae tenuiter coriaceae, ambitu pentagonae, ca. 7.5 cm longae et latae, basi cordatae, 3-sectae, segmento centrali lanceolato-lineari ca. 6.5 mm lato apice attenuato, segmentis lateralibus inaequaliter 2-partitis, lobis lanceolato-linearibus vel anguste lanceolatis, vel indivisae, lanceolato-lineares, ca. 6 cm longae, 6 mm latae, supra prope marginem sparse adpresseque puberulae, subtus sparse crispule adpresseque puberulae; petioli 1.4-7.8 cm longi, glabri, basi paullo dilatati, haud vaginati. Racemi axillares et terminales, 25-45 cm longi, densiuscule 18-30-flori; rhaches cum pedicellis glabrae; bracteae anguste lanceolato-lineares, vel subulatae, 6-23 mm longae, 0.8-1.8 mm latae, sparse puberulae; pedicelli 0.25-30 cm longi, superne 2-bracteolatae; bracteolae anguste lanceolato-lineares, 5-9 mm longae, 0.8-1 mm latae, utrinque sparse adpresseque puberulae, margine ciliolatae. Sepala purpurea, extus dense adpresseque puberula, intus glabra, superum elliptico-obovatum, 11-14 mm longum, 6-8 mm latum, calcare sepalino subulato 13-15 mm longo recto basi 1.8-2.2 mm crasso, cetera oblonga, 10-12 mm longa, 3.5-6.0 mm lata. Petala apice 2-lobata, ciliata. Staminodia ca. 9.6 mm longa, unguibus ca. 4 mm longis sparse puberulis basi breviter appendiculatis, limbis suboblongis ca. 4.6 mm longis 3.2 mm latis prope medium 2-fidis margine longe ciliatis ventre supra basin dense luteo-barbatis. Stamina ca. 4 mm longa, filamentis plerumque margine sparse pilosis. Carpella 3, ovariis ca. 2.2 mm longis apice sparse puberulis, stylis ca. 1.5 mm longis basi sparse puberulis. Folliculi anguste oblongi, 12-16 mm longi, 2.5-3.5 mm lati, subglabri, stylis persistentibus 2.5-3.0 mm longis. Semina brunnea, tetrahedralia, ca. 1.2 mm longa, ad angulos anguste alata.

Affine *D. yunnanense* (Franch.) Franch., quod racemis laxe 3-10-floris, pedicellis usque ad 8.5 cm longis, floribus majoribus, calcaribus sepalinis 17-24 mm longis, petalis apice emarginatis glabris, filamentis plerumque glabris, ovariis saepe dense puberulis.

This new species is closely related to *Delphinium yunnanense* (Franch.) Franch., differing from that species in racemes elongate, densely 25-45-flowered, pedicels shorter, 0.25-30 cm long, flowers smaller, with sepaline spurs 13-15 mm long, petals ciliate and 2-lobed, filaments mostly pilose at upper margin, and ovaries sparsely puberulous only near apex. In *D. yunnanense*, the racemes are laxly 3-10-flowered, pedicels are up to 8.5 cm long, the flowers are larger, with sepaline spurs 17-24 mm long, the petals are glabrous, emarginate at apex, the filaments are mostly glabrous, and the ovaries are usually densely puberulous.

***Delphinium kansuense*** W.T. Wang var. ***villosiusculum*** W.T. Wang et M.J. Warnock, *var. nov.* TYPE: CHINA. Qinghai （青海）: the reaches of Datong River（大通河流域）, between Tien Tang Ssu and Shan Shin Ming （三十名）, alt. 3000 m, Sept. 15, 1915, *Farrer & Purdom 800* (HOLOTYPE: MO).

A *D. kansuensi* W.T. Wang var. *kansuensi* differt racemi rachide pedicellisque pilis mollibus plus minusve patentibus tectis, bracteis bracteolisque dorso sparse puberulis.

This new variety differs from the typical variety in the raceme rachis and pedicels densely covered with spreading soft hairs, and in the bracts and bracteoles abaxially covered with sparse hairs. In the typical variety, the raceme rachis and pedicels are densely covered with appressed short hairs, and the bracts and bracteoles are also abaxially densely covered with appressed short hairs.

The locality of Kansu(甘肅)indicated on the type of this new variety is erroneous (Farrer 1926, pp. 138-237). The typical variety is restricted to the mountainous region of Central Gansu Province and the ranges of the two varieties are separated by approximately 250 km.

***Delphinium shawurense*** W.T. Wang var. ***pseudoaemulans*** (C.Y. Yang et B. Wang) W.T. Wang, *stat. et comb. nov.* BASIONYM: *Delphinium pseudoaemulans* C.Y. Yang et B. Wang, Acta Phytotax. Sin. 30:86. 1992.

*Delphinium shawurense* W.T. Wang, characterized by its leaf lobes being long acuminate or caudate at apex, has two varieties, var. *shawurense* and var. *albiflorum* C.Y. Yang et B. Wang, both restricted to Mt. Shawur, Hoboksar County, Xinjiang Autonomous Region and both with stems mostly glabrous and hispidulous only near the base. The two varieties differ from each other in indumentum of the raceme and in color of sepals. *Delphinium pseudoaemulans* C.Y. Yang et B. Wang is also endemic to Mt. Shawur and its leaves are similar to *D. shawurense*, distinguished from the latter only by its stems being hispid below and sparsely puberulous above, and is better treated as a variety of *D. shawurense.*

***Delphinium delavayi*** Franch. var. ***baoshanense*** (W.T. Wang) W.T. Wang, *stat. et comb. nov.* BASIONYM: *Delphinium baoshanense* W.T. Wang, Bull Bot. Res. Harbin 69(1):12.1989.

*Delphinium baoshanense*, restricted to Baoshan County of western Yunnan Province, is closely related to *D. delavayi,* differing only in its much more strongly divided leaves, and in raceme rachis and pedicels covered with only white appressed hairs. The raceme rachis and pedicels of *D. delavayi* are covered with both white appressed hairs and yellow spreading glandular hairs. Heretofore, *D. delavayi* comprised three varieties. The typical variety is widely distributed on the Yunnan Plateau, neighboring western Guizhou Province, and southwestern Sichuan Province, and in the northern part of its range occur the two other varieties, var. *pogonanthum* (Hand.-Mazz.) W.T. Wang and var. *lasiandrum* W.T. Wang. Geographically, *D. baoshanense* appears to be a variant marking the western edge of the geographic distribution of *D. delavayi.*

***Delphinium umbrosum*** Hand.-Mazz. var. ***drepanocentrum*** (Bruhl) W.T. Wang et M.J. Warnock, *comb. nov.* BASIONYM: *Delphinium altissimum* Wall. var.

*drepanocentrum* Bruhl *ex* Huth, Bot. Jahrb. Syst. 20:419. 1895. *Delphinium altissimum* Wall. subsp. *drepanocentrum* Bruhl, Ann. Bot. Gard. Calc. 5:101. 1896. *Delphinium altissimum* Wall. subsp. *drepanocentrum* (Bruhl) Chowdhury *ex* Mukerjee, Bull Bot. Surv. India 2:293-295. 1961.; W.T. Wang, *Fl. Reipubl. Pop. Sin.* 27:402. 1979. *Delphinium drepanocentrum* (Bruhl) Munz, J. Arnold Arb. 49:94, fig. 13, L. 1968; Tamura, Acta Phytotax. Geobot. 23:100. 1968.

This new combination is necessitated by the editorial policy of the Flora of China Project to recognize only one infraspecific rank within a genus. Use of variety as the infrageneric rank for the Chinese *Delphinium* requires fewer new combinations than use of subspecies.

***Thalictrum simaoense*** W.T. Wang et G. Zhu, *spec. nov.* TYPE: CHINA. Yunnan(云南): mountain west of Simao(思茅), alt. 2000 m, on cliff, *A. Henry 13096* (HOLOTYPE: MO; Isotype: NY). Figure 1.

Herba perennis, tota glabra. Caules aliqui caespitosi, graciles, 9-15 cm alti, 0.5-0.7 mm diam., supra basin vel prope medium dichotome ramosi. Folia basalia 7.0-12.8 cm longa, longe vel longiuscule petiolata, bi-ternata; laminae 5-9 cm longae, 6.2-8.0 cm latae; foliola tenuiter papyracea, orbiculari-ovata, reniformia, vel suboblata, 0.9-1.8 cm longa, 1.0-2.8 cm lata, basi profunde cordata vel subcordata, apice rotundata vel subtruncata, margine inconspicue 3-5-lobulata, pauce rotundato-dentata, nervis supra indistincte prominulis subtus prominentibus retem conspicuum formantibus; petioli graciles, 1.8-3.8 cm longi; stipulae brunneae, membranaceae, lineares, ca. 2.5 mm longae. Folia caulina 1-2, foliis basalibus simila, sed saepe minora, 1.5-6.5 cm longa, 1.5-3.4 cm lata, foliolis plerumque oblatis 0.4-1.0 cm longis 0.45-1.20 cm latis basi subcordatis indistincte 3-lobulatis, lobis margine integris, petiolis 0.2-3.0 cm longis, stipulis ca. 1 mm longis margine laceratis. Monochasia terminalia, 2(-3)-flora; bracteae breviter petiolatae, ternatae, ca. 7 mm longae, foliolis late rhombicis indistincte 3-lobulatis, vel subsessiles, simplices, ellipticae vel ovatae, 2-4 mm longae; pedicelli capillares, 1.7-2.2 cm longi. Flos ca. 1 cm diam. Sepala 4, alba, late elliptica vel elliptica, 4.2-5.0 mm longa, 3.0-3.5 lata, apice rotundata vel obtusa. Stamina 9-15, 3.5-4.0 mm longa, filamentis filiformibus 2.2-3.0 mm longis apicem versus paulo incrassatis, antheris oblongis 1.0-1.2 mm longis apice indistincte breviterque apiculatis. Carpella 10-13, sessila, ca. 2.8 mm longa, ovariis fusiformibus ca. 1.4 mm longis, stylis ovariis subaequilongis subulatis apice hamatis vel circianatis et ventre indistincte stigmaticis. Achenia non satis matura bilateraliter compressa, complanata, sessilia, fusiformia, ca. 1.9 mm longa, 0.5 mm lata, utringue tenuiter 3-costata, stylis persistentibus ca. 1.2 mm longis apice hamato-curvatis.

Affine *Thalictro rostellato* Hook. *f.* et Thoms., quod follis dorso pedicellisque minute puberulis, antheris apice obtusis haud apiculatis, carpellis paucioribus 4-7 carpophoris instructis recedit.

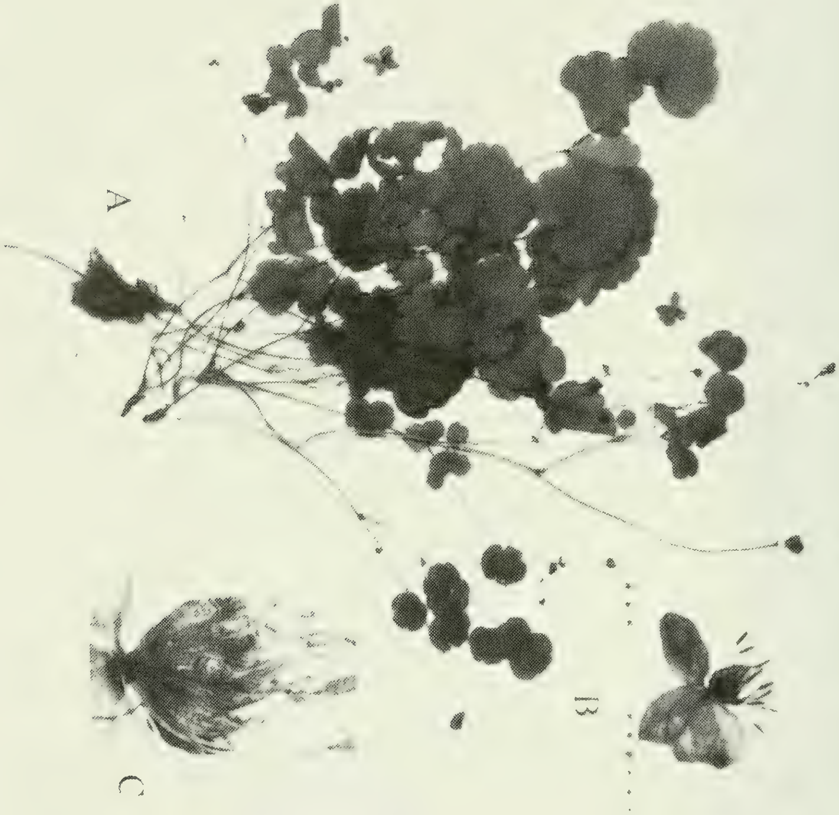

Figure 1. *Thalictrum simaoense* W.T. Wang et G. Zhu, *spec. nov.* (*A. Henry 13096*). A. habit; B. flower; C. flower details showing gynoecium and the filiform filaments of stamens.

With more or less filiform filaments and elongate hooked styles, this new species is related to *Thalictrum rostellatum* Hook. *f.* & Thoms., and is distinguished from that species by the entirely glabrous plant, the shortly apiculate anthers, and the flower with more (10-13) carpels which lack carpophores. In *T. rostellatum*, the leaves abaxially and pedicels are minutely puberulous, the anthers are obtuse at apex, and the flower has 4-7 carpels with carpophores at base.

***Batrachium trichophyllum*** (Chaix *ex* Villars) Bosche var. ***jingpoense*** (G.Y. Chang *et al.*) W.T. Wang, *stat. et comb. nov.* BASIONYM: *Batrachium jingpoense* G.Y. Chang *et al.*, Bull. Bot. Res. Harbin 12:241, fig. 1. 1992.

*Batrachium jingpoense* G.Y. Chang *et al.*, restricted to the northern Heilongjiang Province, is closely related to the northern temperate species *B. trichophyllum* (Chaix *ex* Villars) Bosche, differing from the latter in the smaller and tetramerous flowers with fewer stamens. A widespread species of the genus in China, *B. bungei* (Steud.) L. Liou, has a variety, var. *micranthum* W.T. Wang (Wang 1995), differing from the typical variety also in the small and often tetramerous flowers with fewer stamens. Thus, *B. jingpoense* may be better to be treated as a variety of *B. trichophyllum*.

***Ranunculus*** L. sect. ***Stenoglossa*** (W.T. Wang) W.T. Wang, *stat. et comb. nov.* BASIONYM: *Ranunculus* L. subgen. *Stenoglossa* W.T. Wang, Bull. Bot. Res. Harbin 15:320. 1995.

This new combination is necessitated by the Flora of China Project limitation to a single supraspecific rank within each genus. Grouping the Chinese *Ranunculus* species into sections is more expeditious than use of subgenera.

***Clematis minggangiana*** W.T. Wang, *spec. nov.* TYPE: CHINA. Central Yunnan (云南) : without field notes, 1939, *Ming-gang Li A2872* (HOLOTYPE: GH).

Liana lignosa. Ramuli atro-purpurei, sparse adpresseque puberuli, inconspicue canaliculati. Folia opposita, longe vel breviter petiolata, vel simplicia, laminis chartaceis cordato-ovatis 10.5-12.5 cm longis, 7.8-8.8 cm latis, basi cordatis apice acuminatis margine integris supra as costam et nervos laterales puberulis subtus puberulis, nervis basalibus 5 subtus prominentibus cum nervolis prominulis retem conspicuum formantibus, vel supera aliqua ternata, foliolo terminali distincte petilulato elliptico-ovato vel elliptico, 3-10.8 cm longo, 1.7-7.2 cm lato, basi subcordato rotundato vel late cuneato apice acuminato, foliolis lateralibus breviter petiolulatis vel subsessilibus eo terminali similibus sed minoribus 1.2-7.8 cm longis, 0.5-5.2 cm latis; petiolis 0.8-6.8 cm longis, dense puberulis. Cymae axillares, 1.6-6.5 cm diam., 3-25-florae; pedunculi 1.8-8.2 cm longi, dense puberuli; bracteae vel foliaceae, petiolatae, anguste ovatae vel ellipticae, 1.1-3.3 cm longae, 1-1.4 cm latae, vel lineares vel subulatae 2.5-8 mm longae, 0.3-2 mm latae; bracteolae subulatae, 1.5-5.5 mm longae; pedicelli 0.5-2.5 cm longi, densissime puberuli. Flos pendulus, campanulatus, 1.5-1.8 cm diam. Sepala 4, lutea purpureo-suffusa (?), lanceolato-linearia, 1-1.8 cm longa, 2.5-5 mm lata, apice recurva, extus tota facie intus superne tantum sparse adpresseque puberula, margine dense velutina. Stamina sepalis subaequilonga, filamentis 8-14 mm longis dense villosis, antheris linearibus 4 mm longis glabris. Carpella dense villosa.

Affinis *C. henryi* Oliver, a qua foliis cordato-ovatis margine integris, cymis 3-35-floris, sepalis lanceolato-linearibus intus superne puberulis facile distinguitur.

This species is a new member of the sect. *Campanella* Tamura, and related to *Clematis henryi* Oliver, a species also with both simple and ternate leaves, differing from that species in the cordate-ovate entire leaves, 3-25-flowered cymes, and lanceolate-linear sepals, which are sparsely puberulous above inside. In *C. henryi*, the leaves are lanceolate and with denticulate margins, the cymes are usually 1-flowered, and the sepals are ovate or narrowly ovate and glabrous inside.

The new species is named after the collector, Ming-gang Li, who made important plant collections in central Yunnan Province, particularly in the Mt. Wuliangshan of the Jingdong County, in the thirties of this century.

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